ARMY ORDNANCE

VOL. XIV, No. 84 MAY-JUNE, 1934

The Genius of the French Army

Major General Fox Conner

Bombs Vs. Projectiles

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How Armies are Mechanizing

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Curve-Plotting the Art of War

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Percussion Rifles

J. G. W. Dillin

Facts About "Munitions Makers"

An Editorial

A BIMONTHLY REVIEW OF AMERICAN MUNITIONS
PUBLISHED BY THE ARMY ORDNANCE ASSOCIATION, WASHINGTON, D. C.

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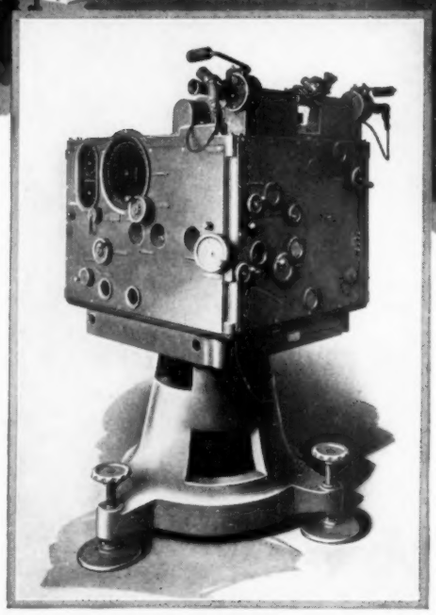

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"The creation of a national foundry for cannon, to be common to the service of the Army and Navy of the United States, has been heretofore recommended and appears to be required in order to place our ordnance on an equal footing with that of other countries. . . . The same reasons induce me to recommend the erection of a manufactory of gunpowder, to be under the direction of the Ordnance Office."—*President Martin Van Buren, First Annual Message, December 5, 1837.*

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THE Army Ordnance Association is a national organization of American citizens pledged to industrial preparedness for war as our nation's strongest guarantee of peace.

The Association endeavors to keep alive an interest in and knowledge of the design, production and maintenance of munitions. Other than a few manufacturing arsenals—six in all—there is no peace-time industry for the production of ordnance. Should war unhappily come again, industrial America will be called upon to produce munitions in great quantity and of intricate and unusual design. In an emergency time will not permit careful study or long preparation for the production of munitions. The problem is one of vital concern.

THE Army Ordnance Association believes that the solution of this problem, based on experience, lies in an active organization at all times coöperating with the Government. The principal objective of the Association is an active membership of American citizens, on whom the duty of design and production of munitions will fall in war, who will have an accurate and authentic knowledge of the complex requirements of ordnance. "Peace insurance" in this form is the foremost aim of the Army Ordnance Association.

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ARMY ORDNANCE, the journal of the Association, is published solely for the purpose of disseminating information on the progress of our munitions developments so that American industry may at all times know its responsibilities to the common defense.

The objectives of the Association as set forth in its Constitution are:

To assist in effecting industrial preparedness for war as being one of the nation's strongest guarantees of peace;

To keep available the highly specialized knowledge necessary for arming the manhood of the nation by stimulating interest in the design and production of ordnance material;

To promote mutual understanding and to effect cooperation with American scientists, inventors, engineers and manufacturers in civil life and the regular and reserve officers of the Ordnance Department;

To provide, when required, the services of competent committees to investigate and report upon special ordnance subjects;

To assist in developing and maintaining an efficient personnel, both commissioned and enlisted, for the units required for Ordnance Field Service in the event of an emergency;

To commemorate the services rendered by the industry of the nation and by the officers and civilian employees of the Ordnance Department in the wars in which the United States has been engaged.

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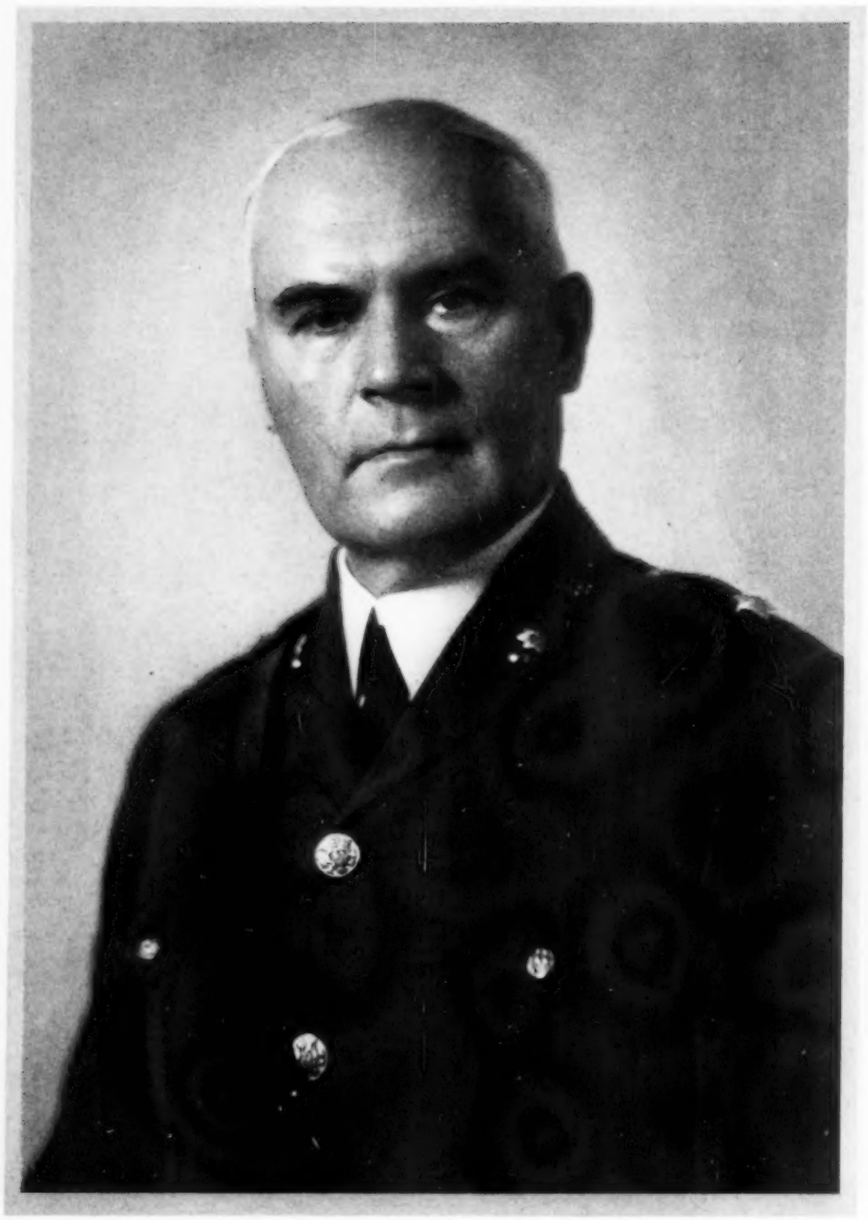

Major General William H. Tschappat
Appointed Chief of Ordnance of the Army
Effective June 2, 1934

ARMY ORDNANCE

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"The Genius of the French Army"

Criticism of a Criticism

By Major General Fox Conner*

IN his book "The Nation at War," General March occupies much space in direct or indirect criticism of General Pershing. Criticism is both stimulating and helpful. The student is stimulated to a more thorough examination of the question at issue and he is helped to a better understanding of the historical or other events involved. This article will concern itself with a single criticism.

General March accuses General Pershing of being profoundly ignorant of French military policy. The specification under the charge is best given in General March's own language: "I am referring to the statement in his book in which he ascribes to the French a military 'defensive' policy, which he regards as the cause of certain of their actions; and adds that this has been the case for fifty years. The fact is precisely the opposite of this statement. The entire French military policy has for years been founded on the attack; always the attack." General March adds that he did not know of General Pershing's "fundamental error" during the war and that—"It did not occur to either of us (i. e., General March and Secretary Baker) that such an entire misconception of the genius of the French Army was possible."

The ostensible cause of the charge and specification is that General Pershing did not always see eye to eye with Marshal Foch. Of the latter, General March says: "As far as Foch was concerned, personally, he was the living embodiment of the attack as the remedy for all ills." If this statement were true, Marshal Foch's ultimate fame would be little greater than that of the proverbial bull that undertook to butt the locomotive off the track. We might still admire his spunk but we could only damn his judgment. "What is really essential is that for each case the respective advantages and weaknesses of the offensive and defensive be thoroughly studied and the possibility of their employment decided upon; in the usual case it is only by judiciously combining and applying the two systems that a powerful offensive can be brought to bear at the desired point." ". . . the spirit of the offensive becomes blind and therefore dangerous when systematically generalized." It seems hardly necessary to cite the various instances, beginning in 1914 and extending into 1918, in which Marshal Foch recommended against, or decided against, the attack as the "remedy" for manifest and acute "ills." For the quotations are from "The Memoirs of Marshal Foch" translated by Colonel T. Bentley Mott and published by Doubleday, Doran and Company, in 1931.

Without indulging in idle speculation as to why General March stresses the fact of not realizing that General Pershing might have "such an entire misconception of the genius of the French Army," let us see what General Pershing really said. Referring to British and French instructors, General Pershing in his book ("My Experiences in the World War") said: "We found difficulty, however, in using these Allied instructors, in that the French and, to a large extent, the British, had practically settled down to the conviction that developments since 1914 had changed the principles of warfare. Both held that new conditions imposed by trench fighting had rendered previous conceptions of training more or less obsolete and that preparation for open warfare was no longer necessary. French publications and manuals were generally in accord with this theory. It was, perhaps, logical to expect that the French should take this view as, nationally, unlike the Germans, they had been on the defensive, at least in thought, during the previous half century. It is true that on occasions the French assumed the offensive, but the defensive idea was ever in mind."

Any well-informed person reading General Pershing's well-founded, conservative statement a second time might well ask—why all the excitement? It is of course true that nothing more than glittering generalities support the charge against General Pershing of ignorance. Nevertheless an enquiry is in order, for the facts which justify General Pershing's statement are of interest. Having been one of the "cohorts" (a term used apparently in its zoölogical sense by General March) of General Pershing, the writer can hardly hope to qualify as an unbiased witness. But it does seem necessary for him to produce some kind of credentials as to his ability to present facts and to justify the right to form some kind of an opinion based on facts. The writer's claim then is based on a considerable study, since 1905, of French military books and other literature; service in a French regiment in 1911 and 1912; service as a member of General Pershing's staff throughout the existence of the A. E. F. While deprecating an excessive use, even when such use is indirect, of the personal pronoun the writer hopes that this experience establishes some ability to lay hands on facts or expressed opinions; he even hopes that his experience may bring him indulgence, and preserve him from being classified with his Chief as profoundly ignorant, should he venture to express an opinion.

THE half century mentioned by General Pershing makes it necessary to go back to 1866 or 1867. As to whether or not the French, "at least in thought," were on the defensive from 1866 to the Franco-Prussian War (1870-71) inclusive, General Langlois would seem to be a competent witness. As a professor and as Commander of the French War College, General Langlois endeavored to show the advantages and possibilities of the offensive. His book, "Field Artillery in

*Commanding General, First Corps Area, U. S. Army. Formerly Chief of Operations, A. E. F.

Liaison With the Other Arms," is perhaps now of more historical than practical interest. But it is little exaggeration to say that when Langlois' book first appeared, in 1892, it was epoch making. Based on tactical requirements, General Langlois laid down the characteristics of modern field artillery. Enthusiasts have referred to General Langlois as the father of modern field artillery. In any event, French constructors, following the characteristics laid down by General Langlois, brought out, in 1897, the famous *soixante quinze*. But General Langlois was no narrow-minded artilleryman. The needs of the other arms, especially the infantry, were the foundation on which he based his studies. So, to repeat, it would seem that General Langlois qualifies as entitled to express an opinion. In the preface to his book, General Langlois says that, due to a false interpretation of the War of 1866, the French infantry from 1866 to 1870 adopted the tactics of passive defense. It will be recalled that in the War of 1866, Prussia humiliated Austria in seven weeks. Further evidence of the fact that from 1866 to 1871 French thought was dominated by the defensive seems unnecessary. If, however, other witnesses are desired, both Marshal Joffre and Marshal Foch may be called.

DURING the twenty years following the Franco-Prussian War, France was without allies. Standing alone and confronted by a victorious and united Germany whose power was growing by leaps and bounds, it was not strange that French thought was almost purely defensive during these twenty years. To parry the next German offensive France began, immediately after the Franco-Prussian War, a veritable Chinese Wall of fortifications.

The name of General Séré de Rivière is still famous in connection with this scheme of barrier forts. So far as the mobile army was concerned the French plans, during this period, contemplated purely defensive battles. Marshal Joffre in his memoirs ("The Personal Memoirs of Joffre"—translated by Colonel T. Bentley Mott—Published by Harper and Brothers, 1932) says that this "poor conception" was dictated by the "haunting thought of German power." Doubtless individuals favoring the aggressive could always have been found but according to no less an authority than Marshal Joffre it was not until the "nineties" that French "strategy became less timid." Marshal Joffre attributes this to the introduction of the high explosive shell and to the experiments which determined the power of this shell against the then existing type of fortification. Perhaps an event more potent, and certainly more logical, in overcoming German domination could be found in the Alliance of 1891 between France and Russia. But even so, the French as a whole remained, "in thought," under the influence of the defensive. Under the French war plans the mobile army was perhaps concentrated somewhat further forwards but reliance was still had on fortifications and the most in the way of the offensive that appears to have been contemplated was the counter attack. During the early eighteen nineties, Marshal Foch was a member of the Operations Bureau of the French General Staff. Marshal Foch tells us that effort centered on the selection of defensive positions and refers indirectly to the prevailing strategical ideas as "solely defensive."

Even the slight tendencies toward shaking off the doctrine of defense were checked by the interpretation which leading French officers put on the events of the Anglo-Boer War. General de Negrier was a member of the Superior Council of War from 1900 to 1904. General de Negrier taught the offensive but he also believed and taught that the development of firearms had rendered a decisive frontal attack impossible. He and other leaders preached the doctrine of inviolability of fronts. Battle was, to many of these leaders of French thought, a thing to be avoided not sought. There was not of course a complete unanimity of opinion. Various doctrines grew up. Among these was the so-called "Strategical Offensive—Tactical Defensive"; which, if it meant anything, was a return to the idea of winning wars by maneuver alone. As always there was a minority but the predominant French thought up to about 1905-1906 was clearly defensive. Of the minority, General Langlois was the most prominent. He believed and taught that battle was to be desired and that fronts were not inviolable. After 1905, the minority became more numerous. But they were, for the most part, comparatively young. Marshal Joffre, in his memoirs, refers to this minority as the "Young Army." The term actually used in France at the time was, however, "*Jeunes Turcs*"; and the epithet did not mean general approval. Nevertheless, the ideas of the minority did grow and after 1905 offensive ideas came into less disfavor. Marshal Joffre in his memoirs seems to attribute this to the lessons of the Russo-Japanese War. It may also be that the possibility of English aid brought about by the Entente Cordiale of 1904 encouraged the leaders of the, to France, new school. The high priest of the *Jeune Turc* movement was Lieutenant Colonel Grandmaison. In 1906, Grandmaison wrote a pamphlet—Training of Infantry for Offensive Combat—in which he set forth his views. Although General Langlois wrote a preface, in which he stressed the offensive idea, it does not appear that Grandmaison's 1906 pamphlet had any immediate effect in drawing dominant French thought away from the defense. But in 1911, when he was Chief of the Bureau of Operations, Colonel Grandmaison delivered and afterwards published two lectures (*Deux Conferences*) which did have effect. Just how far-reaching that effect was and whether it was beneficial or not is to some extent a matter of opinion. I was serving in a French regiment at the peak of the discussion over Grandmaison's ideas. My opinion is that his ideas did not penetrate very deeply into the French Army and further that these ideas were of questionable value. This opinion is held in spite of the fact that Grandmaison's ideas unquestionably influenced the changes, involving a more aggressive attitude, made in regulations just prior to the outbreak of the World War. Before outlining Grandmaison's ideas and enquiring into the extent to which the French Army went in acquiring an offensive doctrine, it is well to recall that beginning with 1911 the French could definitely count on British coöperation in a war with Germany. It is pure sophism to point out that no actual treaty binding England to enter the World War existed. With the knowledge, consent, and apparently at the initiative of both Governments, the military authorities of Great Britain arranged, in 1911, to send six regular divisions to aid the French Army. These arrangements were complete in every detail and included rail schedules, detraining areas, etc. Kept up to date, these arrangements were carried out according to plan in August, 1914; the only important variation being that only four divisions and one cavalry division were sent at first. For its part, the British Navy undertook the protection of French Channel and Atlantic ports. This left the French Navy free to concentrate, as it did, its attention on the

Mediterranean. The adherence of Great Britain to France also made Italy's refusing to march in the Triple Alliance probable.

IN its broad outlines, Grandmaison's doctrine was simple. Grandmaison advocated the offensive under all circumstances; without regard to the enemy, terrain, or anything else. He advocated, in so many words, exaggerating the offensive idea. He admitted being an extremist and evidently took pride in being one. Among other things, Grandmaison said: "Let us go to extremes and perhaps that will not be enough." Grandmaison had the true revolutionary spirit. He aimed at a violent and immediate repudiation of the long-standing French theory of defense. In their memoirs, both Marshal Joffre and Marshal Foch criticize the extreme views of which Grandmaison was the arch-advocate.

Marshal Joffre became Chief of Staff, and Commander in Chief designate, in 1911. In his memoirs, Marshal Joffre devotes considerable attention to the condition of the Army and the theories in vogue. One short sentence may be quoted: "In short, the great mass of the Army, for so long a time compressed in a defensive mould, possessed neither doctrine nor instruction." This sentence is of itself more than sufficient evidence, if any were needed in the first place, to refute General March's criticism. But the efforts of Marshal Joffre to instill some measure of offensive spirit into the rank and file of the French Army should be of interest. Although he was entirely convinced of the intrinsic superiority of the offensive, Marshal Joffre, like Marshal Foch, believed that due consideration must be given to all factors involved. According to his own account, Marshal Joffre saw two immediate reforms as necessary before the French Army could reasonably replace its defensive tendencies by an offensive doctrine. The first reform was to prepare the Army "intellectually and morally" for the offense. The Marshal in his memoirs recites the various steps which he took in endeavoring to inculcate "an offensive doctrine on a reasonable basis." By the fall of 1913 the Marshal evidently thought that he had made progress. In October, 1913, he began the issue of new regulations. In December, 1913, regulations governing the employment of divisions and smaller units were approved.

Marshal Joffre was of course aware that the old regulations paid a certain lip service to the offensive.

Of the Regulations of 1895, which the Decree of 1913 replaced, the Marshal says they ". . . indirectly at least, induced commanders to prefer defense to attack, . . ." It was not until April 20, 1914, that the new Infantry Regulations appeared. Thus the arm which above all others must be endoctrinated with the offensive spirit, if the attack is to succeed, had but a little over three months in which to assimilate the new principles. To the fact that France was thrown into war before the new theories could be assimilated, Marshal Joffre evidently attributes the early reverses of 1914. Marshal Foch for his part thought that the reverses were due to the fact that the new offensive doctrine had been "so greatly accentuated and generalized" naturally resulting in attack tactics "that were blind and brutal."

The second reform which Marshal Joffre foresaw as a prerequisite to an offensive policy was the provision of heavy mobile guns. This was met in very small part before war came.

Marshal Joffre's account ("The Personal Memoirs of Marshal Joffre") of the development and underlying reasons of the plan (Plan XVII) under which France entered the World War is both interesting and instructive. For present purposes it is sufficient to recall that the French concentration kept an entire army, and various groups of reserve divisions as well, in reserve. The concentration appeared to be more "in readiness" than offensive. Marshal Joffre himself says that he ". . . had to be satisfied with a concentration lending itself to various ends." The French planned various field fortifications to be undertaken, and they were actually undertaken, immediately on the outbreak of war. The hastily constructed works in at least one of these localities (those on the Grand Couronné of Nancy) played an important part in limiting the disaster resulting from "The Battle of the Frontiers." One might even make out a plausible case for attributing the salvation of France to the hasty defenses thrown up according to plan on the Grand Couronné of Nancy.

Certainly Plan XVII was far from being the purely aggressive thing that was the plan of Von Schliefflen; even after Von Schliefflen had been emasculated by the more timid Von Moltke.

It is evident that the efforts just before and in the first days of the World War of the French to throw off the long established habits of the defensive were nothing more than one of the offensive interludes mentioned by General Pershing.

General Pershing would be the last to deny the very great debt we owe to the French and the British instructors. But when the time came when we could stand alone it was better from every point of view that we carry on our own instruction. Both the French and British stressed trench warfare to the disadvantage of open warfare training. Until the summer of 1918, French training and French views contained far more defense than offense. On August 27, 1918, General Pershing cabled the Chief of Staff with reference to the difficulty in using the Allied instructors. General Pershing recommended that all instruction in the United States be taken over by our own officers. The cable of August 27th contained this sentence: "American mission this war requires aggressive offensive army based on self-reliant infantry." This sentence and the belief that the Allied instructors in the United States were not contributing to that end inspired General Pershing's cable. The reply was dated August 29th. Among other things it said: "I am in complete accord with everything you advance. . . . (Signed) March."

But anyone is entitled to change his mind.

War between Germany and France is nothing new. Since the dawn of recorded history the Germanic tribes have from time to time invaded France. The Germanic have always far outnumbered the Gallic tribes. As a consequence, France has seldom won against Germany except when the German tribes were divided or when French allies outnumbered the French themselves. There is no stigma on France on account of the fact that her thought during the past half century and more has run to the defensive. Even now, with Germany disarmed, the dominant thought of France is security. Continuing her defensive theories she has since the World War built, at untold cost, another elaborate chain of fortifications along her northeastern frontier. Statesmen attribute much of her foreign policy to the need France feels for building up her defense against Germany.

It has been said that truth is usually found in the middle of the road. Perhaps, but in this case there is not one fact to justify any single point of General March's criticism.

How Armies are Mechanizing

A Summary of Automotive Equipment, Trends and Policies

By Robert J. Icks*

THROUGHOUT the world armies are making use of mechanization in one degree or another, mechanization being considered in the sense that it is the employment of automotive vehicles for military purposes. Although it is somewhat difficult for one individual student to summarize the situation due to the secrecy of many nations with regard to military matters, nevertheless sufficient information has been published in the civil and military press, which, when combined, gives an informative overview of the subject.

This article, therefore has been compiled rather than written. Numerous discrepancies will be noted if a comparison is made, for example, with the "Armament Handbook of the League of Nations." However, the writer wonders if the various War Offices, in reporting the status of their own armaments, do not do so in some cases with their tongues in their cheeks. The total number of tanks, as an illustration, reported by some countries, falls considerably below the number appearing in published press photographs of parades or maneuvers. If this is true in a few instances, it is undoubtedly true in many. For that reason, in this compilation, official figures are not used unless experience indicates their reliability or unless they are in agreement with other sources.

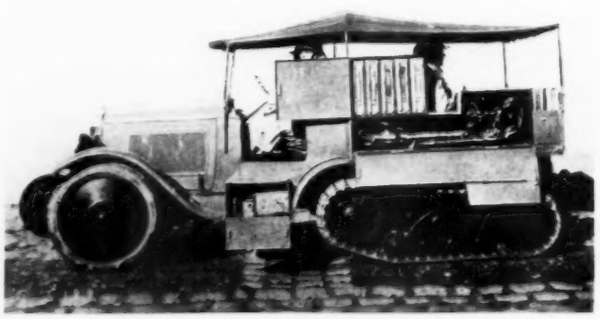
French Cavalry Machine Gun Carrier, Citroen-Kegresse.

Apparently all countries have accepted the fact that both animals and motors have their spheres. A general shaking up in this regard seems to have taken place and opinion appears now to be comparatively settled. Another point on which there seems to be general agreement is that the tactical mobility of the motor is lower than was expected but that it is still greater than that of infantry or cavalry under proper operating conditions. A third point, and one which each country has had to meet, is that until now a condition of experiment has existed. Vehicles of various ages, capabilities, and standards of efficiency have been joined together, a factor which has slowed progress and made difficult the formulation of trustworthy tactical doctrine.

Strangely enough, the offensive has received the bulk of attention, although the defensive would seem to present many interesting and valuable possibilities. In the case of antitank weapons, satisfactory types have appeared in a number of countries but definite antitank organization and training are almost nonexistant. The period of experiment seems definitely over for the larger countries, and to a lesser degree for the smaller countries as well. The future should see greater standardization of fighting as well as transport vehicles. So many words of a general nature have been written about this fascinating subject that the present article was arranged as far as possible in summary form. The comparisons are made by countries in the interests of clarity, giving the present status as well as the policies and trends where these are known. The order in which they are given is roughly that of the extent of mechanization, except that for general comparison with the rest, the United States purposely has been left to the last.

FRANCE: Until recently, French thought in regard to mechanization held to the basic idea that the tank is an infantry-accompanying weapon and works in close cöoperation with the infantry. A change has been apparent for some time. Fire power is an ingrained French principle, and, while armored vehicles are held to infantry as accompanying weapons for the purpose of carrying out the principle of fire power, independent action by these vehicles along the lines of British ideas has become a reality in French maneuvers.

Great use is made of the tactical and strategical mobility of the motor in other branches of their service, principal among the transport vehicles being the Citroen- and Schneider-Kegresse half-track vehicles used by practically all these other branches. The automotive industry is well developed in France and military purchases keep it interested in developing types suitable for the army.



Another View of the French Machine Gun Carrier.

Many of the tanks and armored cars in use are of war-time stock and these are being modernized gradually. German sources report that all the war-time Renaults are to be modernized by the end of 1935. In addition to these are the modern Renault and Schneider and the heavy C and D tanks.

Artillery: 14 portée light artillery regiments; 6 medium artillery regiments, 7 heavy artillery regiments and 33 foot artillery regiments are drawn by wheeled or tracked trucks

*Author (with Jones and Rarey): "The Fighting Tanks Since 1916." Lieutenant, Infantry (Tanks) Reserve, U. S. Army.

or tractors; 5 antiaircraft regiments are equipped with motor guns. The balance of the artillery is horse-drawn or comprises railway or fortress artillery. The motorized portion represents over 40 per cent of the total.

Cavalry: 1 of the 6 cavalry divisions is completely motorized and mechanized and there is one additional mechanized cavalry brigade; the 5 other cavalry divisions have two motorized machine gun squadrons each; by the end of 1934 four of the six are to be completely motorized; 12 motor machine gun squadrons in all in France.

Armored cars: 7 squadrons of 12 cars each.

Tanks: 10 two-battalion light tank regiments and 1 heavy battalion.

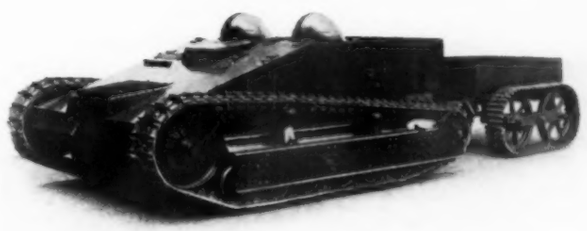
Infantry: 1 of the 25 infantry divisions is mechanized and motorized; several motorized machine gun regiments exist.

Other branches: bridging trains, signal companies, part of the pioneers, and a large part of the transport and train units are already motorized.

Overseas there are additional units as follows: Cavalry: 7 motor machine gun squadrons; Armored cars: 13 squadrons of 12 cars each; Tanks: 4 light tank battalions; Other branches: as above.

The French make considerable use of motorcycle squadrons for coöperation with motorized machine guns, for reconnaissance, and for security and reconnaissance in coöperation with motorized, mechanized, and cavalry units. Seldom are these motorcycle squadrons employed independently. Many forms of light cavalry divisions and motorized and mechanized forces have been tested and the organization seems now to be standardized as follows: 2 motorcycle squadrons, 2 armored car sections, 1 regiment motorized machine guns, 1 light tank battalion, ½ battery motorized light artillery, with special troops added as required.

Recent maneuvers indicate that ammunition supply presents great difficulties and that the mechanized division is too slow because of vehicle congestion. The former is being partly remedied by the use in quantities of the little Renault UE *tracteur d'infanterie* or supply vehicle, while changes in internal organization are being made in an effort to correct the latter. The mixed horse and motorized cavalry units



RENAULT *Tracteur d'Infanterie*, TYPE UE
(Also equipped with steel tracks).

have proven unwieldy but as standardization in motorization continues it is hoped this will be overcome. It is continued because the French place security ahead of reconnaissance, but it is believed a separation will take place whereby the motorized groups will be held in corps and army reserve.

RUSSIA is very much alive in military matters. An evidence of this is found in the large number of military publications and periodicals covering each branch of the service as well as for the Soviet Army as a whole. One of these periodicals is devoted entirely to problems of mechanization and the others feature specific aspects of the subject.

The Russian trend of thought is toward the complete coördination of all arms including aircraft. Combat liaison is the most important doctrine taught and mechanization is but a part of this coördination of effort. Tanks are of three main classes, (1) those of long radius of action, (2) heavy tanks, (3) infantry support or accompanying tanks, in the proportions respectively of 2:1:3. Special artillery support is designed for each of the three as well as aircraft coöperation. The Russian trend is toward the ultimate motorization of all infantry and the shielding of such infantry with protection and reconnaissance units of armored cars, light and very light tanks. Armored vehicles are under the wing of the artillery.

Much of the current motorized equipment and armored car matériel is old but gradually is being replaced. The tank

RUSSIAN LIGHT TANKS, MARKS I AND II.

Russian Light Tanks, Mark III.

matériel is, for the most part new, of Russian and of foreign design, including Russian-built Christies.

Artillery: all 25 heavy artillery regiments and all antiaircraft artillery are motorized, the former partly tractor-drawn and partly tractor-mounted. Some light artillery is also motorized. The entire motorized portion of the artillery represents about one-third. It must be recognized, however, that the agricultural tractor industry is well developed and that the tractors produced have a maximum speed of 12 mph. and are, in part, assigned wartime duties with the army in the event of war.

Cavalry: 1 armored car squadron, 1 tank squadron of 12 fast tanks (and 1 squadron of tankettes are to be included in each cavalry division) under the reorganization begun in 1933; each of the 4 brigades in each division will have a motorized antiaircraft company.

Armored cars: 15 armored car squadrons of 10 cars each in addition to those above. Tanks: 18 light companies; 3 very light companies; 9 heavy companies. Infantry: at least 3 separate motorized infantry battalions; each infantry regiment includes two 3-gun close-support, rubber-tired 76-mm. gun batteries. Other branches: a few pioneer, signal, medical, and train units are motorized.

British Light Tank, Mark IIA.

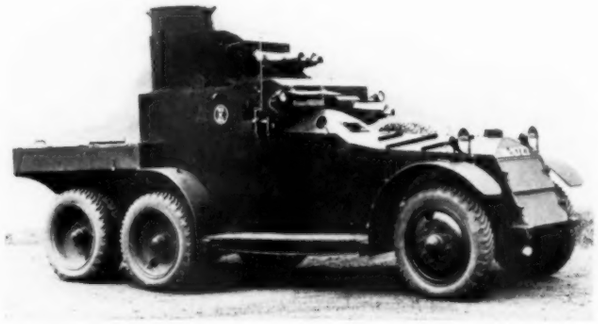
Russia has experimented with independent mechanized units to some extent. The organization of two of these is as follows: (1) 1 motorized infantry battalion, 1 light tank battalion, 1 battery portée light artillery, 1 motorized pioneer company, 1 motorized signal company; (2) 1 motorized infantry battalion, 1 light tank company, 3 very light tank companies, 1 motorcycle machine gun company, 2 batteries portée light artillery, 1 motorized pioneer company, 1 motorized signal company, 1 gas platoon, and 3 airplane sections. In this second organization the security detachments were smaller replicas of the main body.

GREAT BRITAIN: British regulations, while providing for the coöperation of tanks with other arms, indicate independent operations to a greater extent. In the British service, tanks make up a separate arm. Armored cars are also used by this arm as well as by the cavalry and by the Royal Air Force in Iraq, Palestine, and Transjordania. Tanks instead of being held to direct support of infantry or cavalry, work as units in conjunction with these arms. Infiltration by light tanks, the details of which are still being worked out, is a tactical necessity because of the lightness of British tank armor in comparison with that, for example, on French tanks, where very heavy armor is found even on the light types.

The backbone of motorization is the 6-wheel commercial truck utilized by almost all the arms and branches. Tracked tractors are standard for artillery. The older medium tanks are beginning to be replaced by the 16-ton Medium and the Carden Loyd Mark VI types are being replaced by the Light Tank Mark II. British thought is turning definitely in favor of eliminating the medium tank since a satisfactory light type is available and because every function of the medium can be performed by the light.

The British are perhaps the most open-minded of any country in regard to mechanization and their newer equipment is second to none.

Artillery: Almost one-half of the artillery is motorized;



LIGHT LANCHESTER ARMORED CAR—A STANDARD BRITISH CAVALRY CAR.

2 field artillery brigades were motorized by 1926 and 3 more have been motorized since; most of the medium and heavy artillery is completely motorized; all antiaircraft artillery is motorized, the guns being trailer mounted and drawn by truck; 1 battery in each Territorial artillery brigade is motorized.

Cavalry: 2 of the 20 cavalry regiments are armored car regiments; in the other regiments the only motorized portion, except transport in some cases, is the regimental headquarters which includes 9 baby Austin scout cars. Armored cars: 6 companies which eventually will become light tank companies; 8 Territorial armored car companies; 2 RAF squadrons in the Near East. Tanks: 5 mixed and 1 school battalions; 2 light tank companies. Close support artillery and smoke tanks are being issued now to the battalions. Infantry: 1 mechanized and motorized infantry brigade (formerly 2 but one has reverted to foot with horse transport); machine gun units are transported in several types of carriers, half-track trucks, Carden Loyd tracked carriers with tracked trailers, and special 6-wheel trucks carrying two guns with their crews.

Other branches: Certain pioneer, bridging, signal, and other units, including medical, are motorized, principally for experimental purposes; practically all transport of the Royal Army Service Corps is motorized.

A similar trend is apparent in the Empire. The Sudan has a small number of motorized machine gun units. Australia has 1 section of medium tanks and 1 battery in each artillery brigade is motorized. The divisional field artillery of the 2 Australian cavalry divisions is soon to be motorized but that of the 5 infantry divisions is not to be as yet. The Australian Army Service Corps is now being completely equipped with 6-wheel trucks. An armored car regiment is

CARDEN LOYD LIGHT TANK, MARK VI B; USED BY POLAND, CANADA, GREAT BRITAIN AND OTHER COUNTRIES.

to be formed but for the time being using makeshift cars.

Canada has equipped the infantry regiments of the Permanent Force with Vickers Carden Loyd machine gun carriers and tracked trailers. The Union of South Africa has recently decided to mechanize to a considerable extent. Some development in this direction is also apparent in India where the native troops are beginning to be provided with motor transport. In New Zealand there are a few motorized artillery units and definite antitank sections in each of the 12 infantry battalions. Ireland has cadre armored car and tank units.

POLAND has followed the lead of France for many years and it is therefore not surprising that Poland has tended toward a free and greater use of mechanization after the British example, as has France. Although, in the past few years, Poland has been handicapped by stocks of a heterogenous nature, this is being overcome and modern equipment is the

FIAT LIGHT TANK.

order of the day, most of it imported or built at home under license. The tanks are of modern French and English design, the motor equipment of French, English, and Italian.

Artillery: 1 of the 31 light artillery regiments is in an experimental motorized state; the 11 heavy regiments are motorized, some with Pavesi tractors and some with Vickers Carden Loyd tractors; 1 mountain artillery regiment and the 1 antiaircraft regiment are motorized. Cavalry: 5 cavalry regiments have very light tank sections; the 15 cavalry brigades each have 1 armored car squadron. Armored cars: 8 squadrons forming part of the tank organizations. Tanks: 5 light tank regiments with varying internal composition; 1 heavy tank battalion. Infantry: Experimental motorized battalions. Other branches: 1 of the 8 pioneer battalions is motorized; some of the other special troops as well as one-half of the transport and train units are motorized.

Experimental units have been tested in maneuvers. Some of these were organized as follows: (1) an experimental light division composed of a staff, 4 cavalry regiments, 1 horse artillery regiment, 1 motorized infantry regiment, 2 squadrons of half-track armored cars, 1 platoon of very light tanks,

TYPES OF TANKS IN CURRENT USE
(Does not include experimental models)

	Renault 17	" 26	" NC27	" 28	" NC31	Cardiusewicz	Ruskij	Mk I, II, III	6 Ton	Fiat 3000	T-3 Medium	Christie 32	Big Racer	Vickers Medium	" C	16 Ton	Osaka (Lt. & Med.)	6 Ton	Mk IIA Light	C. L. Mk VI	Amphibious	Patrol	Landakrona	KH 50-70	M2 1	Chars C-D	80 Ton	Mk V (Wartime)	Med. B "	Fiat 2000
Albania										x																			
Australia														x															
Belgium	x																			x									
Bolivia																		?		x									
Brazil	x																												
Canada																				x									
Chile																				x									
China		x																		x									
Czechoslovakia	x																			x				x					
Denmark			x							x																			
Esthonia	x																										x		
Finland	x																												
France	x	x	x																	x					x				
Great Britain														x		x		x	x	x									
Greece	x		x																										
Holland		x																											
Hungary																				x									
Ireland															x												x		
Italy										x										x									x
Japan	x		x												x		x			x									
Jugoslavia	x		x																										
Latvia		x																									x	x	
Lithuania	x	x																											
Persia		x																											
Poland			x	x		x														x					x				
Portugal					x													x				x							
Roumania	x																	?		x									
Russia							x	x		x		x	x	x						x	x						x	x		
Siam																							x						
Spain	x	x			x																								
Sweden	x																						x		x				
Switzerland		x																											
United States									x		x																		

1 motorcycle squadron, 1 maintenance squadron, and motorized transport; (2) a cavalry brigade consisting of 1 armored car squadron, 1 light tank platoon, 2 light machine gun companies, 1 heavy machine gun company, 1 howitzer battery, 1 platoon of field artillery, 1 antitank detachment, 2 radio units, and a headquarters unit; (3) an infantry organization of 1 motorized infantry battalion, 1 light tank platoon, 1 platoon of portée field artillery, 1 antitank platoon, 1 signal company, 1 pioneer company, 1 medical company, and train; (4) 1 battalion of motorized infantry, 1 platoon of portée artillery, 2 armored car squadrons, 1 company of fast tanks; (5) 1 platoon of very light tanks, 1 armored car company, 1 platoon of motorcycle machine guns, 1 battery portée field artillery, and 1 radio platoon.

ITALY has been open minded on the subject of mechanization for a number of years. Her vehicles are excellent and adapted for use over the varied Italian terrain. For some time experiments have been taking place to evolve an all-purpose vehicle for transport purposes to supplant, if possible, even pack transport. The new 1-ton capacity *autocaretta* with a tread of three feet and a width of four feet seems to fulfill the requirements. For motorized infantry, the 6-wheel Fiat 604 is in general use. The armored cars are mainly old vehicles but newer ones are being acquired. Tanks are the light and heavy Fiat and the Carden Loyd built under license in Italy.

Italy is advancing along the lines of French thought but with greater emphasis on the mobility of the entire army. An experimental light division was tried in the 1933 maneuvers. It was composed of 3 cavalry regiments, 1 horse artillery regiment, 1 motorized and mechanized Bersaglieri regiment, 2 motorized field artillery brigades, 1 light tank company, 2 armored car companies, and special troops. As with the Russian experiments, this force was protected by

TYPES OF ARMORED CARS IN CURRENT USE
(Does not include experimental models)

	Wartime models	Rolls-Royce 14-24	Rolls-Royce 26	Crossley 23-25	Guy-Vickers	Light Lanchester	Morris	Schneider	Autocheniille 23-29	White	Breda	Sumida	TK-6	Skoda (PA)	25-26	T-2	T-4	La Salle
Afghanistan	x																	
Albania	x																	
Argentina			x															
Austria														x				
Belgium	x																	
China	x																	
Czechoslovakia	x													x				
Esthonia	x																	
Finland	x																	
France									x	x								
Germany	x																	
Great Britain		x		x	x	x												
Greece	x																	
Holland	x																*	
Ireland	x	x																
Hungary	x																	
Italy	x										x							
Japan	x		x									x						
Jugoslavia	x																	
Latvia	x																	
Lithuania	x																	
Persia			x										x					
Poland	x							x										
Russia	x																	
Roumania	x																	
Siam							x											
Spain	x																	
Sweden															x			
Turkey	x																	
United States																x	x	x

smaller replica groups, and in addition, these smaller groups were used for darting thrusts backed up by the main body. Large mechanized groups of the British type are not suitable for the poor road net in the mountainous character of a probable theater of war.

Artillery: 4 motorized light artillery batteries; 66 medium and 48 heavy batteries motorized. Pavesi wheeled tractors are used by the heavy artillery; a very small percentage of the light artillery is motorized but about half of the heavy artillery is thus modernized. All heavy artillery is to be motorized eventually. Cavalry: all trains in units higher than regiments, are now motorized. Armored cars: 1 battalion and 7 separate companies of 7 cars each. Tanks: 6 battalions. Infantry: several Bersaglieri regiments have Carden Loyd machine gun carriers as well as motorcycle machine guns; eventually all infantry is to be motorized for strategic mobility. Other branches: much of the transport is already motorized under the Army Motor Transport Service. All field and combat trains are to be motorized, as well as engineer troops.

Colonial forces also show an advance in modern equipment, there being 2 motor transport groups and 4 armored car squadrons, as well as armored and unarmored motorcycle machine gun units.

JAPAN: Mechanization is continuing in Japan as rapidly as economy will permit. In the meantime the most significant feature of the Japanese attitude on the subject is that all personnel is to be trained in this method of warfare by means of exercises, maneuvers, tactical problems in the field and on maps. Thus far the Japanese have developed tanks and armored cars and are beginning to use other motor equipment as well, purchased mainly from foreign sources but manufactured at home also. The tanks are of French, English, and Japanese manufacture. The artillery tractors are American. Mechanical transport is believed in strongly.

Artillery: heavy and medium artillery is partly motorized with tractors. Mountain artillery in Manchuria is portéed.

Cavalry: Each brigade has 2 armored car squadrons of 10 cars and 10 armor-shielded motorcycles, a headquarters section of 8 to 12 armored motorcycles, and a special motorized antiaircraft section; field trains are being motorized.

Infantry: A few regiments have machine gun carriers;

Characteristics of Armored Vehicles in Current Use

Tanks

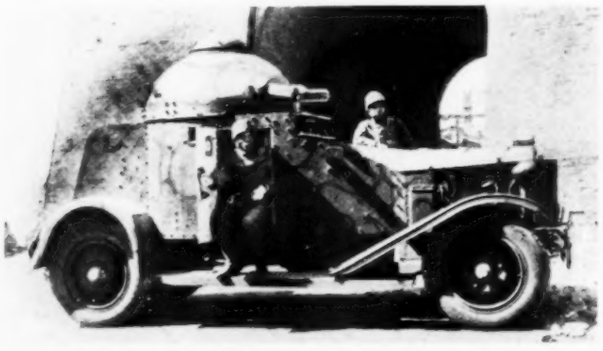
TYPE	Crew	Armament	Armor (inches)	Weight (tons)	Speed (mph)	Radius (miles)	REMARKS
Renault 26	2	37-mm. or MG.	.25-.6	7	8		Improved M 17.
Renault 27 NC	2	37-mm. or MG.	.79-1.18	8.7	11.5	70	Coil spring suspension.
Renault 28	2	37-mm. or MG.	.25-.6	6.5	14		Coil spring suspension.
Renault 31 NC	2	37-mm. or MG.	.79-1.18	8	12	70	Coil spring suspension.
Cardasewicz	2	37-mm. or MG.	.25-.6	6.5	9		Steel cable suspension.
Russkij	2	37-mm. & MG.	.25-.6	7	7		Fiat engine.
Mk I, II, III	2	37-mm. & MG.	.217-.59	7	10	70	
6 Ton	2	37-mm. or MG.	.25-.6	7.25	5.5	30	U. S.
Fiat 3000	2	37-mm. or 2MG.	.236-.629	5.5	14	105	
T3 Medium	2	37-mm. & MG.	.25-.625	10.5	30	170	Christie convertible wheel and track.
Christie 32 Big Racer	2	37-mm.	.375-.5	6	60		Turret like U. S. T1-E1 Light.
Vickers Med	5	3-pdr. & 2-3MG.	.31-.59	11.2-13.5	16	120	Various turrets.
Vickers C	4	3-pdr. & 4MG.	.31-.59	11.9	18.6	144	
16 Ton	4	3-pdr. & 5MG.	.5-.8	17.92	31		Automatic transmission.
Osaka	4	6-pdr. & 2MG.	.866 Max.	15.5			
6 Ton	3	47-mm. & MG.	.2-.67	8	21.75	100	Improved Renault type.
Light MK IIA	2	MG.	.275-.35	3	35	125	
Carden Loyd	2	MG.	.24-.35	1.9-2.5	25-30	60	Various hulls.
Amphibious	2	MG.	.275-.35	3.1	40		Russian model; driver left; turret right.
Patrol	2	MG.	.276-.433	2.2	30		C-L with turret.
Landskrona	4	37-mm. & 2MG.	.314-.853	11.57	25.8	93	Very silent.
KH50-70	2-3	35-mm. or MG.	.25-.5	8.3	7.5	126	Wheel & Track.
M21	4-5	37-mm. & MG.	.39-.59	10.5	13	60	
2C	13	75-mm. & 4MG.	.9-2.12	75	10	60	
3C	13	155-mm, 75-mm.	.9-2.12	81.5	8		
1D	15	& 4 MG.		101.4	11		
80 Ton	8	2-76-mm. & 4 MG.	.35-1.16	88	6		Believed to be Modified Mk V.
Mark V	8	2-6-pdr. & 4 MG.	.2-.47	31.9	4.6		Rigid suspension.
Medium B	5	4 MG.	.24-.55	20	8	62	Rigid suspension.

Armored Cars

Many of the standard armored cars are constructed on commercial automobile chassis but a few have special characteristics or are designed as fighting vehicles primarily. For example, the Autochenille, Schneider, and U. S. T2 are half-track vehicles; the Breda is amphibious; the Skoda and TK-6 are more or less symmetrical front and rear; many standard cars can be operated forward or backward at all speeds; the *Sumida* operates on highways or railroads; the six- and eight-wheel cars of various makes employ auxiliary detachable tracks.

infantry is motorized as required by conditions of campaign; each infantry division has 6 to 8 tanks for instructional purposes. German sources report that, since the 1932 and later experiments, it seems certain that each infantry division is to be augmented by the inclusion of a motorized antitank and antiaircraft group as well as by a mechanized regiment comprising 1 company of very light tanks, 1 motorcycle company, 1 company of armored cars; 1 motorized battery of light artillery, 1 motorized signal company, 1 to 2 motorized infantry companies with machine guns, and 1 company of chemical warfare troops.

CZECHOSLOVAKIA: Artillery: 36 light artillery batteries, 66 medium batteries, 4 antiaircraft regiments, are motorized. This represents about one-fourth of the light artillery and all of the other. Cavalry: Each of the 4 cavalry brigades has an armored car squadron. Armored cars: 6 additional companies of 12 cars each. Tanks: 12 battalions, one for each infantry division plus 1 school battalion, the latter now being expanded to a full regiment. Other branches: considerable transport and a few special units are motorized.



Japanese Rolls-Royce M26 Armored Car.

The following experimental unit has been tested in maneuvers: 3 cavalry regiments, 1 cyclist battalion, 1 motorized infantry battalion, 3 batteries motorized field artillery, 1 motorized howitzer battalion, 1 armored car company, 1 motorized signal and 1 motorized pioneer company, motorized train and 1 mixed pursuit and bombing air squadron, and has been adopted tentatively as the war-strength organization of a cavalry brigade.

ROUMANIA: Artillery: The 10 existing antiaircraft batteries and some of the other artillery is known to be motorized. Armored cars: several companies. Tanks: 4 light tank regiments. Infantry: 4 motorized regiments.

BELGIUM has followed unobstrusively the advances in this field ever since the World War. In fact, during the war, the Belgian Army used armored cars, tanks, portée artillery, and pneumatic-tired field guns drawn by trucks. However, from 1928 to 1932 budgetary limitations caused a curtailment of experiment. French half-track and English tractor vehicles are coming into use at the present time. Advances are being made in the colonies as well.

Artillery: 6 light artillery and 3 medium batteries and part of the 1 antiaircraft regiment are motorized. Cavalry: The 1 cavalry corps includes 6 cavalry regiments, 2 cycle regiments, 2 horse artillery regiments, 2 armored car detachments, and 2 cycle pioneer battalions. The cavalry regimental trains are horse drawn but the staffs are motorized as are the cyclist regimental trains. Tanks: 3 light tank companies. Infantry: several regiments are already equipped with Carden Loyd Oerlikon antitank units; 1 infantry brigade is to be mechanized in 1934.

SPAIN: Artillery: all artillery and all ammunition trains are to be motorized and are now in process. Cavalry: the

JAPANESE OSAKA MEDIUM TANK AT SHANGHAI, 1932. THE LIGHT OSAKA IS A SMALLER REPLICA OF THIS TANK.

5 cavalry brigades have motorized machine gun units of which there are 2 squadrons total. Armored cars: a few units with obsolete equipment. Tanks: 2 two-battalion light tank regiments and 8 divisional tank companies. Infantry: divisional machine gun units are motorcycle units; there are also several independent machine gun squadrons. Outside the mainland there are motorized artillery and pioneer units.

PORTUGAL: Artillery: already equipped with Citroen-Kegresse vehicles; all antiaircraft artillery motorized, the weapons believed to be the new Vickers-Armstrongs, drawn by Carden Loyd tractors. Cavalry: each of the 2 cavalry brigades includes a motor machine gun squadron. Tanks: 1 mixed regiment. Infantry: motorized infantry is in process of experiment. In the colonial forces there are motorized antiaircraft artillery, field artillery, motor transport, and tank units.

SWITZERLAND: The Swiss are testing Pavesi wheeled artillery tractors. Much of the heavier artillery is motorized, all of the artillery trains and one-half of the other train units. Swiss cavalry regiments utilize both horse and motor transport. Cyclist regiments include motorcycles and motorcycle machine gun sections.

JUGOSLAVIA has experimented with motorized infantry and artillery. The motor equipment is modern. A 4-company tank battalion exists.

DENMARK: Artillery: 23 of the 41 artillery batteries are motorized, including 8 antiaircraft batteries of the latest Vickers-Armstrongs type. Cavalry: each of the 2 cavalry regiments includes in addition to cavalry, cyclist units and 2 armored car companies. Other branches: about one-third of the transport units is motorized.

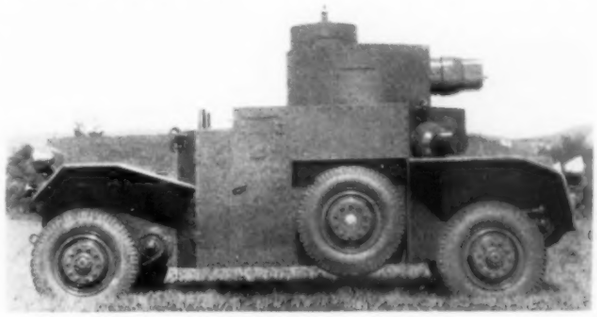
SWEDEN: Experimental infantry and artillery units are motorized. New Landskrona type tanks are likely to supplant the present M 21 and Renault types. Artillery: 1 antiaircraft regiment motorized; other artillery now in process. Cavalry: includes special light troops comprising motorcycle troops and motorized machine guns. Armored cars: 1 company. Tanks: at least 2 companies.

HOLLAND has experimented with motorized infantry, artillery, and transport equipment, and has a small number of armored cars.

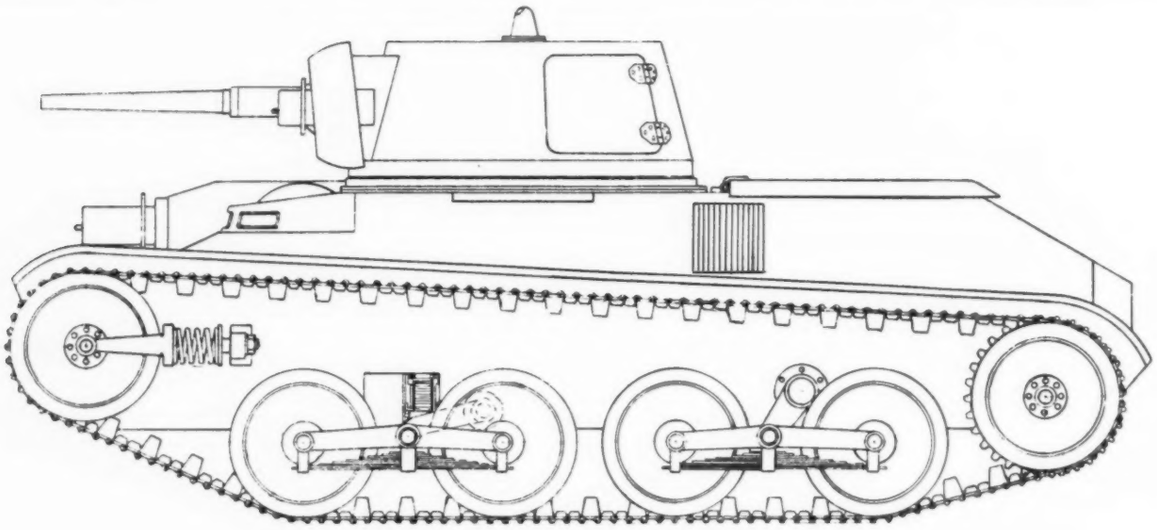
BOLIVIA: Under German leadership the Bolivian Army was reorganized and equipped with modern tanks of English manufacture. After the opening of the war with Paraguay, considerable motor transport was added.

AUSTRIA: The appreciation of the value of the problem began early in 1923 through the efforts, primarily, of that great student, Major Fritz Heigl. In 1928 motorization began on a small scale. Artillery: 2 of the 6 104-mm. artillery batteries are drawn by trucks, the guns being mounted on trailers. In addition, Cletrac tractors are portéed for use in placing the guns in position. Armored cars: 1 company. Infantry: as below. Other branches: 6 motorcycle and truck companies used also for infantry transport; 6 motorized train companies; some pioneer companies are motorized. In 1930 a *Schnelle Brigade* was tried in maneuvers.

GERMANY: Although German official thought states that the tank is obsolete and "overshadowed by other instruments of modern warfare" the Germans are keenly interested in de-



PERSIAN ARMORED CAR, CHRISTIE TYPE SUSPENSION.



Swedish Landskrona Medium Tank.

velopments elsewhere and are training to oppose armored vehicles as well as to use them. Motorization is a subject of much study and experiment for the transport of troops, supplies and weapons. Train units are already motorized in great part. A 4-gun motor battery is a part of each infantry division. War strength organization contemplates a 77-mm. gun battery with each infantry regiment which will serve as an antitank unit.

Dummy armored cars and tanks are used in maneuvers. The Germans believe armored cars and motorcycles are fitted for strategic rather than tactical reconnaissance. Germany has rejected extensive use of motorcycles, believing cavalry cannot be replaced by such equipment because of its inherent defects. In regard to cavalry, the German view is almost the antithesis of the French in that a mixture of motors and cavalry would congest, and its unwieldiness would prevent, proper reconnaissance.

Other countries: Afghanistan, Albania, Argentina, Brazil, Chile, China, Esthonia, Finland, Greece, Hungary, Latvia, Lithuania, Persia, Siam, Turkey, and other countries have tanks, armored cars or motorization in varying degree, or all three.

Tank Ratios
(Available Tanks per 1000 men of Active Armies)

COUNTRY	Active Army	Total Tanks	Modern Types Only
Belgium	89,224	.55	.28
Czechoslovakia	138,000	.8	.7
Denmark	8,100	.75	.75
Esthonia	13,533	1.00	.....
Finland	31,575	1.00	.....
France	607,000	5.3	4.00
Great Britain	403,192	1.5	1.5
Greece	85,875	.2	.2
Holland	28,500	.04	.04
Italy	457,189	.38	.36
Japan	225,000	1.04	1.03
Jugoslavia	138,934	.61	.25
Latvia	23,000	.89	.3
Lithuania	19,466	1.59	.75
Poland	332,100	1.85	1.65
Portugal	39,800	1.5	1.5
Roumania	244,850	.5	.3
Russia	848,600	.59	.5
Spain	209,500	.97	.95
Sweden	33,500	.59	.02
Switzerland	494	4.5	4.5
United States	132,069	7.2	.26

United States: The policy of the United States Army was definitely stated by the Chief of Staff in his last two Annual Reports. Mechanization and motorization are to be utilized in carrying out the normal functions of the various arms and branches and are not to be ends in themselves.

Tanks are held to the closest possible direct coöperation with infantry but are permitted more latitude tactically in the cavalry. Fire power is becoming a principle almost as ingrained as in France.

Artillery: One-half of all 75-mm. artillery will have truck-drawn pneumatic-tired guns in the United States, and all such artillery in Hawaii will be so equipped; all medium and heavy artillery will be motorized; 6 antiaircraft regiments and 3 mobile coast artillery regiments, as well as much of the National Guard artillery will be motorized.

Cavalry: 1 regiment of the 15 is completely mechanized, and eventually there will be one more; 1 battalion of high speed artillery is being equipped for the mechanized brigade; 3 divisional tank troops; 1 divisional and 2 brigade headquarters and headquarters troops and several regimental headquarters troops to be motorized, as well as the field trains of all cavalry regiments in the United States and the Philippines.

Armored cars: 2 squadrons, one for each cavalry division.

Tanks: 2 regiments and 7 divisional tank companies and 14 National Guard tank companies.

Infantry: Headquarters and military police companies of 3 divisions, headquarters and headquarters companies of 4 brigades, headquarters and headquarters companies (except howitzer platoons) and field trains of all regiments, the machine gun and howitzer platoons of 1 division, 2 regiments, and 1 battalion, all in the United States, are to be motorized; in Hawaii, the headquarters and headquarters companies, and field trains of 2 brigades and 4 regiments; in the Philippines, the same units in 1 brigade and 2 regiments are to be motorized; combat trains in a number of regiments already exist.

Other branches: 5 divisional signal companies and 1 signal troop are to be motorized; all Air Corps ground troops; 7 engineer regiments are to have motorized field trains and 1 in addition, will have a motorized combat train; all but one Chemical Warfare units and all divisional quartermaster and ordnance units will be motorized.

This article is based on information believed to be authentic and errs principally, perhaps, on the side of conservatism.

Bombs Vs. Projectiles

Relative Value of These Weapons in Naval Warfare

By Logan C. Ramsey*

CONTROVERSIES as to the value and essential character of various types of naval vessels have arisen from time to time in the naval history of every maritime power. Certain types and methods have been seriously challenged not only in naval circles but before the court of public opinion as well. In some cases the force of the arraignments has been admitted and the existing naval policies have been modified. In other instances, the proposed changes have encountered so concerted an opposition that they have been defeated. In still other instances wide divergencies of opinion and other factors have permitted the individual problem to remain unsettled. During the past decade in our own country an important question has been raised. The general public is aware that this controversy is centered upon the relative potentialities and values of aircraft and surface vessels or, more specifically, battleships. The average naval officer believes that the question has been definitely decided by the existing naval policy calling for building and maintaining a balanced fleet with the fullest development of all types permitted by the dictates of national policy and within the limitations of naval appropriations. This policy, thoroughly understood as it is by the service, has not received widespread publicity because it lacked those spectacular qualities that at times appear to be the sole criteria of news values. Consequently, a surprisingly large percentage of the general public believes that the Navy has failed to utilize aircraft to the best advantage and has, because of ultra-conservatism and the stultifying effects of time-honored naval tradition, persistently clung to obsolescent types of surface craft to the detriment of the national defense. Very recently a generally well-informed civilian, considerably above the average in intelligence, asked a naval aviator of his acquaintance the following question: "Don't you fellows encounter a good deal of opposition and jealousy from the regular line officers?" His polite incredulity upon being answered emphatically in the negative is indicative of a somewhat popular misconception. For these reasons the writer believes that a general review of the question may be of value at this time.

Naval craft of all types, whether aërial, surface, or submarine, are essentially and primarily the means of transportation for placing a weapon or a trained observer in a chosen and advantageous position. As the process of observation is auxiliary to the employment of the weapon, the real problem, stripped of its nonessentials, is not the choice of a means of transportation for the weapon but rather a selection of the most suitable type of weapon. The true nature of the controversy under discussion is then resolved into a choice between the aircraft bomb and the large-caliber naval gun instead of one between the airplane and the battleship, provided, of course, that one believes a selection must be made between the two—a selection requiring an amendment in the existing naval policy and a definite commitment in favor of one type to the practical abandonment of the other. If such a choice is, for the sake of argument, deemed necessary then that selection must be made upon the basis of the relative values of the two weapons involved. The means of transportation for the selected weapon, being concomitant and connoted, will naturally follow. In making such a choice certain comparisons are to be considered, such as effectiveness of hits from projectiles of the two types; rapidity of fire; accuracy and volume of fire; availability for use under varying conditions of time, locality, distance and weather; and vulnerability to hostile activities.

IN considering the relative effectiveness of hits, we are faced with a somewhat general popular misconception regarding the size of aërial bombs that may, considering the present stage of aërial development, be deemed practicable for use in naval warfare. Having been regaled with descriptions of the havoc that would be wrought by a 4,000-pound bomb and having viewed with great interest genuine photographs of actual bombs of this enormous size, the public has overlooked the fact that there are certain practical difficulties tending to preclude their use in naval warfare. These deterrents arise chiefly from the fact that aircraft are definitely limited as to the weight that can be carried aloft. Any increase in the military load must be achieved at the expense of the amount of fuel the plane is capable of carrying. A shore-based plane to be of real value against hostile surface craft must be capable of operating at least 500 miles from the coast. Considering the cruising speed of such a plane to be 125 miles an hour and that 2 hours of operation at the maximum distance from the base would be sufficient, it is apparent that the plane would require fuel for about 10 hours of flying. To carry a 4,000-pound bomb the plane would have to possess the ability to lift a weight, in fuel and armament alone, of something in excess of 10 tons. This, of course, would connote a plane of truly enormous size. While the design and construction of such a plane is possible, even if implying a higher degree of aeronautical development than obtains today, the size and lack of maneuverability inherent in such a design would subject it to a maximum of hostile aircraft attacks even though its own defensive armament could be made quite formidable. In addition, the inevitable drawbacks of such a design would be relatively slow speed and a moderate ceiling. These two factors would cause the plane to be exposed to antiaircraft fire from surface vessels for a longer period of time than would be the case when smaller and faster planes are considered. Likewise, it would afford such an excellent target for such defensive gunfire that it is very doubtful, barring surprise or exceptionally favorable weather conditions, if it could reach the requisite dropping point over an alert enemy battle line. Therefore, until aircraft design reaches a considerably higher stage of development than obtains at the present time, it appears logical to conclude that the 4,000-pound bomb is impracticable for use against surface vessels with shore-based planes, even at moderate distances from the coast and for long-range operations it is an obvious impossibility. It might be argued that a plane to carry a bomb of this great size might

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be based on shipboard and, because of the relative proximity of its base to the actual scene of operations, be able to accomplish its mission without the necessity for transporting such a tremendous load of fuel, which, in turn, would permit of a smaller and faster design. Such an argument, however, would be advanced seriously only by those who do not realize such a plane would involve a total weight far greater than any ever lifted from the deck of a carrier and enormously in excess of any ever launched by catapulting.

It must not be construed that the writer is attempting any decrial of the potentialities of aviation or believes that the future of aeronautical development holds anything other than the most brilliant prospects. The foregoing arguments have been advanced merely to support his contention that this case is one of the numerous instances where the general public has been misguided by extravagant claims of super-enthusiasts with the result that the progress of aviation has suffered more from this cause than from its own limitations. In order to demonstrate definitely that this last statement is not a hypocritical disclaimer by a reactionary naval officer who fears that the reader might impute a blind and unreasonable jealousy of a new branch of military science that an apocryphal tradition ascribes most unjustly to the Naval Service as a whole, the writer trusts that the reader will pardon the interjection of a few personal observations. First of all, after considerable service as a naval aviator (13 years), I am firmly convinced that we are just entering an era during which an accelerated rate of aeronautical progress will obtain and that the words of Rudyard Kipling regarding aviation—"We are at the opening verse of the opening page of the chapter of endless possibilities"—hold good today just as when they were first written. Finally, as a naval aviator I have never experienced any of the hostility some writers ascribe to the line of the Navy. With respect to the alleged jealousy the only serious remark made in my presence since 1923 that could possibly be construed as such was one made recently by a senior officer, for whose judgment and abilities I have the utmost respect, to the effect that the absorption by naval aviation of such a high percentage of the outstanding officers of the line was retarding development in other important directions and that if it continued a readjustment of officer personnel would be necessary! Therefore, I hope that the reader will agree that statements made in this paper as to what *cannot* be done by contemporaneous planes is based, not upon a lack of appreciation of the possibilities of aircraft, but rather upon more or less personal experience with the limitations imposed by the present state of aeronautical development.

If, then, it appears reasonable to exclude the 2-ton bomb from serious consideration, no such summary dismissal is defensible in the case of one half that size. It is true that no plane of intermediate speed and moderate size actually exists that is capable of carrying a 2,000-pound bomb great distances from its base. However, designs are in existence that could function while carrying this load at a distance of 500 miles from the base. At the present time these types are not designed for shipboard use, although the writer is of the opinion that the present stage of development in aeronautical engineering is sufficient to produce a plane of this type which would involve a design of relatively great wing span. It would operate to reduce the number of planes that could be borne on deck of any given carrier, not only because of the actual space occupied but also because of the increased difficulty in moving planes of such a size about on the flight deck. In fact, it appears quite reasonable to presume that the total weight of bombs capable of being dropped by all of the planes of a single carrier would be greater if the smaller plane should be used even though such a choice would involve a reduction in the weight of the individual bomb that could be carried by each plane to, for example, 1,000 pounds.

We have, then, as a basis for comparison of hitting effectiveness of the two weapons, the 16-inch-gun projectile on one hand and the 1-ton or 0.5-ton bomb on the other, the bomb weights depending upon the basing of the plane carrying the weight. Roughly speaking, the gun projectile of that caliber weighs as much as the larger of the two bombs. Obviously there exists a considerable latitude of choice with respect to the ballistic disposal of relative weights of case and explosive charge in either projectile. The limits to this choice in both instances are approximately equal so that, within reasonable limits, any given design of bomb may be approximated ballistically in a gun projectile and vice versa. Naturally there are certain limits beyond which the percentage of weight in the gun projectile devoted to the charge may not be increased as the terrific pressures inside the gun during firing necessitate a strong casing. However, the present ballistic arrangement is one of choice and could be modified so that it would approximate, at least, that obtaining in the type of bombs designed for use against naval targets.

In practice, however, aircraft bombs which strike the target with less velocity than do big gun projectiles are designed to compensate for lack of penetration by increased disruptive force; in other words, they have a higher percentage of disposable weight assigned to the explosive carried.

This lesser striking velocity of the bomb results from the fact that any freely falling object in an atmosphere increases its speed of fall under the influence of the acceleration of gravity and against the air resistance. As the aerodynamical resistance increases at a higher mathematical rate than does the increase in velocity, a balance is eventually reached beyond which point no further increase in the velocity of the falling object is possible no matter how long the fall may continue. This maximum velocity, which varies with the shape of the object in question, is called its terminal velocity. That of the human body falling freely in air is approximately 112 miles an hour while that of the best streamlined aërial bomb is about 1,200 foot-seconds. However, to achieve this terminal velocity the bomb must be dropped from a relatively great altitude. The striking velocity of the gun projectile, on the other hand, is relatively unaffected by gravity and is more of a function of muzzle velocity and air resistance. The striking velocity of gun projectiles is greater than the terminal velocities of aircraft bombs, and the disparity in favor of the shell increases with a decrease in the relative range, below the expected battle ranges, not only because of increase in the striking velocity of the gun projectile at such ranges but also from the decreased speed of the bomb that is dropped from an altitude less than that requisite to the attainment of its terminal velocity.

Therefore, in weighing the relative effectiveness of bomb and big-gun hits, we have a theoretical equality in disruptive force and an actual penetrative advantage for the gun projectile. The mere fact that armor-piercing shells for use in naval guns actually carry a smaller weight of explosive than do aircraft bombs of equal weight cannot be advanced as an argu-

ment in favor of the relative effectiveness of the bomb hit, as the choice is a deliberate one and can be modified to parallel any general ballistic arrangement in the bomb that could be proved to have definite points of superiority. Even if the 4,000-pound bomb later proves a practicability for use in naval warfare, it must be remembered that the projectile from a 20-inch naval gun would equal it in weight. While no 20-inch gun actually exists this is due to the present limitation upon the size of naval guns by international agreement rather than to any insuperable difficulties in the construction or service of such a weapon. When the 2-ton bomb definitely enters the picture there is no real reason to presume that future arms limitation agreement may not result in a similar arbitrary restriction on the size of aircraft bombs or in an increase in the maximum permissible caliber of naval guns. Hence the bomb hit merely equals the gun hit in disruptive force and has somewhat less penetrative effect at extreme ranges, while at intermediate distances the disparity in favor of the gun projectile is greatly increased. In fact, those who argue that the bomb hit is more effective than that of a big-gun are in reality and in the final analysis arguing, not the case of the plane versus the battleship with the broad strategical and logistical implications involved, but rather the older and more limited ballistic controversy between the advocates of the high-explosive projectile and those who prefer one of armor-piercing quality.

WHEN the accuracy of bomb dropping and gunfire is compared, the question of range is a primary one. In the case of the big gun, the battle range may be considered as being between 15,000 and 25,000 yards, as only exceptional circumstances would justify or require engagement at ranges outside of those limits in either direction. The normal dropping altitude for bombs depends upon the method used in aiming the missile. If a bomb sight is used to determine the proper dropping from an appreciable altitude over the target, surface gunfire will probably force the plane to approach at an altitude of at least 10,000 feet. Aerodynamic considerations would probably preclude the possibility of a heavily laden plane making the necessary attack from an altitude greater than about 15,000 feet. If the bomb is to be dropped at the end of a dive in which the pointing of the plane at the target serves as the process of aiming, the point of release may be 1,000 feet or slightly less. Considering these ranges as the expected battle ranges and as normal, we may assume, in view of the recent development in the accuracy of bomb dropping, that the bomb has an equal, if not slightly better, chance of hitting than does the projectile fired at comparable ranges. The bomb launched at the end of a dive may be considered as having been dropped at point-blank range and should hit with great frequency. However, this method of bomb dropping, while of great accuracy, suffers from the limitation of the size of bomb that may be employed. Such a dive with the necessary recovery subjects the plane to tremendous stresses and a bomb of 1,000 pounds is considered to be the heaviest that could be used at present. Naturally, if the range is reduced in either instance, an increase of accuracy in both gunfire and high-altitude bombing may be expected, but as such ranges could ensue only from abnormal conditions, the expected battle ranges form the fairest basis for comparison. In accuracy, then, we have an equality between gunfire and high-altitude bombing while dive bombing, although more accurate than either, suffers from the use of a smaller projectile.

IN individual rapidity of fire, the advantage rests entirely with the big gun, which can fire every 30 seconds or less. The individual plane, for the purposes of any single naval engagement, must be considered as being a single-shot, non-reloadable device for the launching of a bomb. For shore-based planes operating at a distance from their base this is obvious, while for carrier-borne aircraft rearming would involve a return to the carrier, reloading, and refueling, a second take-off and climb for altitude and finally a return to the scene of operations—a matter of hours. But when we come to consider volume of fire from the standpoint of collective effort, the advantage accrues to the other side as an aërial striking force may, to use a current colloquialism, "shoot the works" long before the battle line has made any visible inroads in its ammunition supply. In this connection the number of planes available is the governing factor. With our present force of battleships, approximately 100 bombing planes (a conservative figure), each carrying a 2,000-pound bomb, would be required to deliver a weight of metal equal to a single broadside from the big guns of the battle line. If 200 planes were available, the aërial force could be accorded a superiority in volume of fire in the ratio of 2:1, and so on. The relative volume of fire between bombing and big-gun fire, is, therefore, dependent upon the numerical strength of the aërial striking force. If we arbitrarily limit the ammunition supply of the battleship to the very moderate figure of 100 rounds per gun, a force of 10,000 bombing planes would be required to equal the total weight of projectiles that the battleship force could hurl. While such an aërial force, or perhaps one half that size, could overwhelm and destroy the battle line because of its tremendous superiority in volume of fire, its materialization is chimerical if only because of the obvious difficulties in basing and supply.

Next to be considered is the relative availability of the two weapons for use under varying conditions. Because of the multiplicity of factors involved, the scope of this paper permits of discussion only in the most general terms. The first of these factors is that of range of action. As previously stated, the present stage of aërial development limits the operations of heavily laden aircraft to approximately 500 miles from their base. The big-gun carrier, on the other hand, has a range of action about eight times as great. Battleships may maneuver for days near the expected scene of operations while the endurance of planes is limited by their fuel capacity and is measured in hours. The bomb, because of the vastly greater speed of its vehicle, may be brought into action sooner than can the big gun with respect to any locality that is within the range of its means of transportation. On the other hand, at least one-half hour must elapse between the command for the take-off of the bombing planes and the actual dropping of their projectiles, while the big gun can be expected to fire within ten minutes after the sounding of the call to general quarters. When weather conditions are to be considered, it is true that there are certain relatively rare occasions when the operations of the big gun would be hindered and those of the bomb carrier facilitated. Nevertheless, unfavorable weather conditions may be usually expected to affect aërial operations more adversely than those of surface craft. In summation, it should be obvious that while certain factors are more favorable to the use of the bomb, the big gun may be considered as being more universally available under varying conditions.

There remains for discussion the relative immunity of the

means of transportation of these two weapons to hostile activities. In the case of the plane, its chief protection is a function of its speed and maneuverability, while that of the battleship is derived from its structural strength. The battleship has, as one of its primary attributes, the ability to continue in action after being struck; the plane would be brought down by almost any sort of a hit. Naturally the problem is to hit the plane. This difficulty arises rather from its inherent speed and maneuverability than from the increased complexity of surface gunfire due to the introduction of the third dimension. Hence, the obvious remedy is to use a plane that nullifies as far as practicable this great asset. Such planes, designated in the naval service as fighting planes, possess greater speed and maneuverability and are admirably adapted for attacking the larger and slower bombing planes. As a discussion of aërial combat is not pertinent to this paper, it will suffice to say that a certain percentage of losses may be expected in a bombing squadron as a result of hostile aircraft attacks, following which the surviving planes must run the gauntlet of antiaircraft fire before reaching the requisite point for the release of their bombs. Therefore, one is fully justified in stating that the bombing plane suffers in comparison with the battleship in ability to continue its activities in the face of hostile resistance.

It appears that a preponderance of factors operates in favor of the big gun and that, if an immediate choice must be made between the two weapons, it would be one to the prejudice of the aircraft bomb. However, such a definite commitment would prove a step backwards and shut the door to a line of development that offers almost limitless prospects in the future. Also, it is entirely conceivable that circumstances might arise in which an aërial striking force, even if of moderate strength, might prove a more effective bulwark to the safety of the nation at that time than all the battleships afloat. To deprive ourselves of such an arm would be the equivalent of trusting the safety of the nation to luck. Conversely, even the most prejudiced are forced to admit that conditions might obtain that, while nullifying completely the ordinarily great potentialities of the bomb carrier, would permit of the unhampered utilization of surface craft armed with big guns. Is, then, the safety of the nation of such slight importance that it need not be safeguarded by forces capable of meeting any situation that might arise? If the answer is "No," then the existing naval policy requiring the building and maintenance of a balanced fleet with the fullest development of all arms—surface, submarine, and aërial—is both logical and sound.

To demonstrate the matter more clearly, it might be profitable to consider the logical results of depriving the fleet of either aërial bombs or big guns. By the elimination of an aërial striking force, we would be able to devote all of the capacity of our carriers to scouting and fighting planes and thus improve the scouting efficiency of the fleet as well as its ability to defend itself against hostile aircraft. However, by so doing we would relieve the enemy of the necessity for preparing against a serious aërial attack unless the prospective engagement was certain to take place within range of our shore-based planes.

If, on the other hand, we should decide to deprive our fleet of its battleship force and of its big guns, we could not effect the necessary changes as easily and as simply. In the first place it would be necessary to seek for a modification of the existing arms limitation agreement to permit us to increase our carrier tonnage. In view of the known attitude of certain foreign powers this would not be granted without considerable concessions of an indeterminate nature. It would then be necessary to build the additional aircraft carriers and their planes while training a large additional number of naval aviators. During and until completion of the process of transition, the safety of the nation would require the maintenance of the battleship force in full commission. Hence, even if the change could be effected rapidly, a considerable expansion in naval personnel would be involved with the attendant extra expense. After the process was completed, the need for the extra personnel would disappear and we would be forced to undergo all the evils inherent to a reduction in personnel. Let us assume that the dangerous period of transition can be safely undergone. The fleet would then consist of a main body of aircraft carriers together with supplementary cruisers, destroyers, and submarines. The function of these auxiliaries would be the protection of the main body against enemy light forces and the securing of information for its guidance. Our fleet, because of the vulnerability of the carrier type, would have to avoid surface contact with the enemy. This would impose the necessity for constant maneuvering at high speed upon our fleet which, in view of the increased fuel consumption at such speeds, would act to the detriment of the effective range of action. This implies an increase in the difficulty of defending our nearer possessions, such as Hawaii and the Panama Canal, and would render the defense of those more distant practically impossible with resultant far-reaching political implications. It is true that the carriers themselves might be large enough to carry the greater fuel supplies necessary, but the smaller units of the fleet would be greatly handicapped in the absence of high speed, large cargo capacity, fuel ships capable of refueling those units at sea. The lack of battleships would increase the over-all vulnerability of the fleet to hostile aërial attacks and particularly so with respect to what would then be its major units, the carriers. Most critics will admit that a 2,000-pound bomb will sink or put out of action any type of naval vessel other than battleships or battle cruisers. Hence, a single bomb hit on any unit of the fleet would rob us of its services. In addition, a potential enemy, knowing that he would not be opposed by heavily armored vessels, might profitably discard his armor-piercing projectiles in favor of one having small penetrative qualities but carrying a larger charge of explosive. Such big-gun projectiles would then rival the effectiveness of the aircraft bomb against a lightly armored vessel and we could expect the loss of a unit of our fleet every time the enemy scored a hit with any weapon. In summation, a fleet of this composition would have the following comparative disadvantages: greater vulnerability, particularly to a surprise attack; inability to defend our over-seas possessions as well as does the present fleet; the necessity for avoiding surface contact with the enemy; decreased range of action; and inability to operate its most effective weapon under as wide a range of weather conditions as would a more balanced fleet. Its relative advantages, higher speed, and a greater volume of fire can hardly be considered as fully commensurate.

The final conclusions that may be drawn are: (1) the big naval gun is at present the most effective naval weapon; (2) the aërial arm of the fleet is complementary rather than subordinate and thus essential; (3) the building and maintenance of a balanced fleet composed of all types is essential to the safety of the nation.

Percussion Rifles

Third in the Line of Evolution of Rifled Guns

By J. G. W. Dillin*

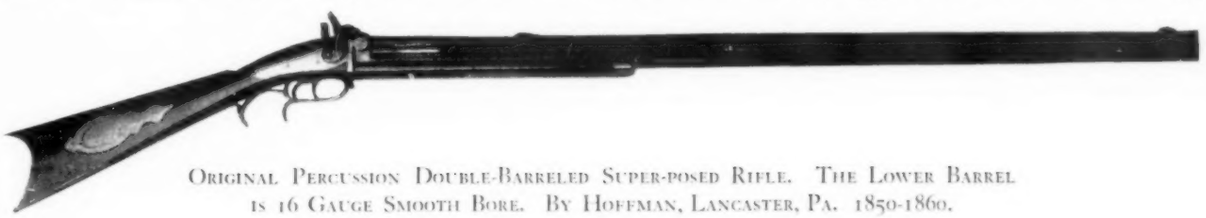
THE percussion muzzle-loading hunting rifle stands third in the line of evolution of rifled guns. First comes the fire lock, then the flint lock, and then the percussion, which I shall take for the chief subject in this article.

The percussion principle of ignition—later known as the percussion system—was the invention of a Scotch clergyman, named Forsyth, who in 1805, discovered a way to ignite powder other than by flint and steel. In 1807 Forsyth was granted a patent on his invention, but in the interval between 1805 and 1807, his ideas were copied by various persons, Forsyth's patent was superseded by better ideas and his place as the originator of the principle became a negative quantity. Of these infringments, first in line came the pill lock, the feature being in the form of a pellet or pill of fulminating powder which caused ignition from a blow instead of a spark. This was followed by the year 1815, by a metal cap rather similar to those used until the end of the percussion period, which from a standpoint of general use terminated about the year 1885. Thus it was that the percussion principle as applied to the muzzle loader, in shot gun, revolver and pistol, lasted little more than half a century. As compared with its predecessor, the flint lock, it passed away in the days of its youth. So much has been written in recent years concerning the flint-lock rifle and early arms in general, that I will make but limited reference to them. Rather, I will dwell upon the muzzle-loading percussion gun and tell the story as I know it. Before I proceed, may I say that I have seen and handled a very large number of both flint-lock and percussion rifles. Not very long ago I was looking over an old collection of arms which included an early fire lock of apparently Arab origin. Imagine my surprise to find that it was a six-groove rifled gun, of the long slender type. I was not long getting a rod to explore the barrel and, as might be expected, found it to be a straight cut, with deep grooves and a muzzle that was slightly belled. This gun both in type and workmanship suggested a product of the early seventeenth century. It was about a 70 caliber and highly ornamented.

But to go on with the muzzle-loading percussion rifle. This arm was in general use by 1840. Slowly the flint lock gave way to its invasion and although many hunters were loathe to part with their old stand-bys, the percussion principle had come to stay. By 1845 it was recognized as the standard American hunting arm. Very few flint locks were made after that date. The early percussion period was not marked by many new productions for the gunsmith was too busy converting the flints to the new percussion principle. Sometimes new locks were fitted but often the original flint lock was dismantled and reconstructed to meet the requirements of the new idea.

ORIGINAL PERCUSSION RIFLE WITH THE EARLY PATCH BOX—NOTE THE HALF STOCK, PERIOD 1850.

The following advertisement from a New York paper, dated 1827, will convey a very good idea as to what was being done along percussion lines at that early date. It proves that the percussion principle was adopted much earlier than many—including the writer—were willing to believe. (The advertisement shown on page 344 is also of historic meaning.)



ORIGINAL PERCUSSION DOUBLE-BARRELED SUPER-POSED RIFLE. THE LOWER BARREL IS 16 GAUGE SMOOTH BORE. BY HOFFMAN, LANCASTER, PA. 1850-1860.

1827

JOHN P. MOORE'S

MILITARY

and

SPORTSMAN'S WAREHOUSE

No. 208, Broadway.

Nearly opposite St. Paul's Church, N. York.

Muskets, Fowling Pieces, Rifles, Pistols, Swords, Dirks, Epaulets, Sashes, Feathers, Cords, Laces, &c., constantly on hand; with every article in the Military and Sporting line.

Flint Guns and Pistols altered to the Percussion principle, and all repairing done in the best manner. A constant supply of percussion priming caps.

The process of converting the flint to percussion was as follows: A new hammer, the Pan Frizzen, and spring was taken off and the screw holes plugged. The pan was cut out

*Author: "The Kentucky Rifle." (See note page 367.)

and the seat rounded to accommodate the round drum feature that screwed into the base of the barrel upon which the cap nipple was seated. This drum feature was a round tube-like affair of iron about ¾-inch long by 7/16-inch in diameter. It was then bored from the inner to the center, the channel being about ⅛-inch in diameter and ending directly under the nipple which was threaded and screwed into the drum, thus making a complete flame passage from the cap resting upon the nipple to the charge of powder in the barrel. The percussion hammer was vastly different from that of the flint lock and was useless as a feature in the conversion. To convey some idea as to the amount of business done by the gunsmiths in converting the flint to percussion, I may say on several occasions I have talked with old smiths who well remember having seen piles of old flint locks and parts that had been put aside and sold to the junk man for old iron. On one occasion several hundred pounds were sold by one smith. The new percussion rifle that followed the converted flint lock was a distinct type. At first it clung closely to flint lock lines with full length stock, long brass patch box and the drum principle of the convert, but comparatively few of this class were made. The new type to which I have made reference followed immediately or at least as soon as the smiths had worked up into percussions their remaining stock of flint lock materials which could be used in the fabrication of these new rifles, thus making the unusual percussion that we sometimes encounter. This was *not a convert*, but an original percussion that *clings close to flint lock lines.*

Where is constantly kept the most extensive assortment of warranted

Double and single barreled

GUNS, RIFLES, MUSKETS,

AND PISTOLS,

OF HIS OWN MANUFACTURE, AND IMPORTED.—ALSO,

SPORTSMENS' APPENDAGES,

Such as Game Bags, Powder Flasks, and Horns, Shot Belts, Dogs' Collars, Chains, Whips, and Whistles.

SUPERIOR POWDER,

SHOT, PERCUSSION POWDER

AND PRIMERS, &c.

IN VARIETY—ALSO,

GUN LOCKS, MOUNTINGS,

And component parts, suitable for the trade.

WHOLESALE AND RETAIL.

***** Repairs promptly and neatly executed.**

Y

Advertisement in "The American Shooters' Manual," 1827.

The engraving at the head of the advertisement was used as a business card as early as 1818 and is identical with that used in 1790 by H. W. Mortimer, gunmaker to George III, except that the royal arms have been removed and Tryon's name and address substituted. (Collection of W. C. Southwick, New York.)

THE new percussion rifles were represented in four types. The first was the regular single-barrel hunting rifle. The second the super-posed or over and under. The third was the mule ear and the fourth the double barrel side by side. Distinguishing features between these new rifles and their predecessors, the flint locks, were very pronounced.

The stock of this new gun extended from one-third to one-half way to the muzzle. From the end of the stock to the muzzle an iron rib, holding the rod pipes, was brazed to the barrel. The rod pipes, or thimbles as they were generally called, were of iron instead of brass. The barrel as a rule was much shorter. The caliber was reduced so that the average would not be greater than a 42, whereas the flint lock would perhaps average as much as 46. The curly maple stock, so much prized by the early smith, gave way generally to walnut and cherry, although occasionally maple was used. The long and beautiful patch box was no more; it was substituted by a small round box in which the caps were stored. The grease and patches were carried elsewhere. The lower stock was narrower—often too much so. The crescent butt plate was highly developed and very often too narrow for the shoulder of a large man. The time-honored brass trimmings so conspicuous in flint lock days had given way to German silver or wrought iron. The trigger guard was narrow and sometimes had a spur-like attachment for the finger. The drum feature found in the conversions as mentioned was discontinued. Instead, the nipple was seated upon a stationary ledge or block, a part of the barrel, with a hole bored and threaded. The nipple was screwed in so that the flame contact would strike the powder charge near the top instead of the bottom as was the case with the flint lock. Often a patent breech was supplied, this being common with late guns. The hammer of the percussion gun was as a rule clumsy, heavy and unsightly and gave the gun a common appearance. So much for the new long rifle, or as it was often called, the deer rifle.

The super-posed rifle was an interesting piece and a great many were made by the Pennsylvania smiths. There were two types of these guns: one with revolving barrels and another with barrels stationary. The first mentioned used one lock and the second two. The former had both barrels rifled, each barrel being supplied with both front and rear sights of the regulation hunting type. As a rule these guns were about a caliber .45 and cut with six grooves. The lands and grooves being of equal width, it carried one ram rod; on the side opposite the ram rod, was a very neat brass rib which ran the entire length of the barrels held in place by four flat keys that passed between the barrels and engaged a similar rib on the opposite side, to which the pipe rods were fastened. It was a strong and attractive feature, giving the gun a finished appearance. To revolve the barrels of this rifle, it was first necessary to raise the hammer to half cock. In some instances, a trigger-like device ahead of the guard was pulled with the index finger which released the catch and with the other hand

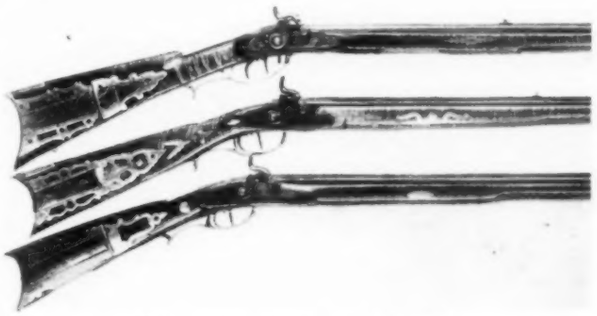
the barrels would be turned to firing position. These rifles were made with back action lock. The barrels were octagon and comparatively light. Great care had to be taken in placing the cap on the nipple, owing to the fact that the under barrel had no cover over the nipple. The cap must therefore fit tight to insure its retention while the rifle was in service. The super-posed rifle, having two hammers and rigid barrels was constructed with a rifled barrel above and a smoothe bore below. The former was about a caliber .45, and the latter a 16 bore. This was a great favorite with the deer hunter. He used about a 2½-dram charge of black powder, a heavy wad on top, then 6 No. 1 buckshot. Occasionally a round ball, about ¾-ounce, was used. It was put under the buck then a wad between, similar to loading a shot gun. The hunter invariably fired the rifle first, then the smoothbore for a running shot; at under 40 yards it was a killer with the buck-shot alone. This gun was often made with both barrels round. The nipples were set very close to the barrels. The right trigger and hammer fired the upper or rifled barrel; the left fired the shot. Owing to the fact that the lower nipple was set ¾-inch lower than the one on the right side, the striking point of the hammer being correspondingly long, and as the two locks were set to one height, the long-nosed feature of the left hammer gave the gun a rather unique but particularly artistic appearance. The superposed rifle was seldom made with barrels more than 37 inches long. The barrels were thin to reduce the weight, which rarely exceeded 10 pounds.

Many Pennsylvania smiths specialized on this rifle. John Schuler of Liverpool, Perry County, must have turned them out in numbers, for at this late day I have come across no less than nine bearing his name, which is cut deeply in script on top of the barrel. Schuler's workmanship can be classed as from good to beautiful.

Hoffman, of Lancaster, was another superposed rifle specialist. He turned out a superb gun of the stationary barrel type. One specimen that I saw had the top of the rifled barrel octagon and the lower, a smooth bore, was round. Daniel Boyer and Nathan Klaus, both Eastern Pennsylvania smiths, were celebrated for their fine productions of flint superposed rifles. The first named operated in the Lehigh district and was a late maker of the period of 1820. His rifles were beau-

ABOVE: ORIGINAL FLINT; BELOW: ORIGINAL PERCUSSION.

tifully made and sometimes carried a well cut Masonic emblem engraved on a brass plate as the chief ornament. His guns, although heavy, were artistically made. Klaus was a much earlier maker. His rifles were of beautiful design and elaborately decorated. Just where his shop was located the writer has never been able to learn. His rifles are typical East Pennsylvania construction of the period of 1800. There were many other shops in Pennsylvania where the superposed rifle was made. With reference to this type of rifle it must be said that it was a valuable arm and was so considered with the old time hunter. It is hard to determine just where the idea, as embraced in this gun originated. A few years ago I came across a gun of this type by either a Swiss or German maker that was dated 1763. It was a short unwieldly arm and embraced the same ideas and principles as the American super-posed above described. Whether the makers got their ideas from the early American smiths or vica versa is a question that will not likely be determined.



CONVERTED PERCUSSION RIFLES.

The mule-ear rifle was made in both single and superposed. The locks of both were back action. The hammer of the single was a straight bar of iron, about 2½-inches long by ½-inch thick and ⅜-inch wide. It was set in aligment with the lock and barrel, the upper end being made in cup-like form to protect the cap upon which it rested, an ear-like feature shaped to fit the finger served as a lifter to raise and lower the hammer. This superposed rifle was made with stationary barrels, the nipple of the upper barrel setting low and of the lower setting high, thus the nipples were close together. One hammer was used with a joint that could be shifted up and down, thus firing both barrels with one hammer and one lock, instead of two locks and two hammers, as in the instance of the superposed previously described. This mule-ear gun, like the other with stationary barrels, had the upper barrel rifled, the lower smooth. This type of rifle came rather late in the percussion period and was never made in great numbers. It was a practical arm and, because of its single lock feature, represented true economy in the cost of production.

Still another percussion arm in both rifle and smoothbore was made about the middle of the percussion period, and although a rather freakish idea, several makers produced them. It was called the under-hammer, the lock hammer and nipple being set ahead of the trigger guard. The lock was made on the same principle as used on the single barrel percussion pistol, there being no side lock plate. The lock features were centered directly under the breech and ahead of the trigger guard. Several types of hammers were used on these guns. This arm in both rifle and shot gun was in single barrels only. They were hammerless guns for all the term implies so far as hammer obstruction to line one sight is concerned.

THERE remains one more pattern of the percussion rifle yet to be described. It is the side-by-side double barrel. This rifle, rarely exceeding 38 inches, was shorter in barrel length than the superposed. While not numerous, I have seen some that were very artistically made. These guns were mostly made with both barrels rifled. In caliber they run from about a 38 to 42. They were double-barrelled rifles for

all the term implies. When one barrel was made a smooth bore it was invariably the left, both barrels being the same diameter externally. The shot barrel, being bored to shot gun thickness, was equipped with a heavy center top rib and the regulation front and rear rifle sights. When both barrels were rifled, it was next to impossible to get satisfactory results with the center sights, due to the fact that the delivery from the two barrels would never be the same. However, the difference would not be sufficient to be a serious drawback in using the rifle as a big game killer. At 50 yards the points of ball impact would vary from 2 to 6 inches, but doubtless this gun would be a failure at the shooting match. In all probability, this fact accounts for the comparative few specimens made. Here I must add that on two occasions I have seen the double-barrel rifles with two sets of sights. The barrels sighted individually and to sight the rifle thus it was necessary to cover both barrels with a heavy bridge, for at least three-fourths over. This gave the arm a rather clumsy appearance with an additional weight. Of the several smiths who made these side-by-side rifles, I will mention the John Krider shop at 2nd and Walnut streets, Philadelphia. One beautiful specimen of his work has been examined many times by the writer. It apparently has never been fired and rests in the shop where it was made, 70 or 80 years ago. It has one set of sights only and is a thing of beauty in both design and workmanship. This rifle weighs about 8½ pounds and has a cherry stock.

N. Lewis, located somewhere in western New York state, specialized on these double rifles and was a master workman. The writer has owned two of his products.

The Lewis Rifle has a very peculiar feature. With the lock mechanism it has but one notch in the roller, i.e., at full cock. When one or both hammers are cocked it is entirely safe and cannot be fired in the regular way. To fire it, the rear, which is the set trigger, must be drawn back in the manner of all set triggers. In the event of both hammers being raised at the same time they cannot be fired separately. Thus to fire a single shot one hammer only can be raised. Just what object Lewis had in this unusual arrangement seems uncertain of a correct explanation at this late day. However, one thing is certain that on some occasions both barrels were to be fired simultaneously, possibly at big game standing and where the chances of a miss were remote, two balls being more deadly than one. This theory is the writer's guess. Readers may draw their own conclusions. But this I must add: Lewis was a genius and a mechanic. His locks were beautifully made and functioned perfectly.

In addition to these well defined types there were freaks in a literal sense, and I will not attempt to describe them. except to say that some were true freaks. Others had merit, but not sufficient to create a demand and their importance was of minor concern. I have now described the several types of muzzle-loading hunting rifles as I have known them. And now a word on the loading features of these very interesting arms to which the *early* Pennsylvania rifle smith was the first to apply a greased linen or buckskin patch to the round ball in loading. This is far more than a theory, the evidence being so conclusive that it is very safe to accept it as a fact.

Examples of Mule-Ear Single Barrel Rifles, Period 1845-1860, Using the Flint Patch Box.

I have made a careful examination of scores of the early European rifles and in not one instance have I found the slightest trace of grease or patch in the covered boxes that are found in the stocks. On the contrary, their interiors show unmistakable wear from flints and small tools, in sad contrast with what we find in the American rifle for in it you find the box a mass of old grease and patches. A few years back I wrote a high authority on arms in Sweden with the idea of ascertaining what he might know concerning this subject. He replied in a most courteous manner, but could throw no light upon the situation.

As to the loading of the muzzle-loader, the percussion rifle like its predecessor the flint lock had to be handled with care. Both were sensitive to dampness and the hunter while in the woods on rainy days was ever on the alert. Invariably he carried the lock part of his piece under his arm and with this precautionary measure no trouble would be experienced. I have hunted in all kinds of weather with both the percussion and flint and have no hesitation in saying that with either gun no trouble would be experienced when properly handled. But keep them reasonably dry! In the instance of the flint lock, the hunter would often wax the pan cover after the priming powder had been placed. This was done especially when the bushes were covered with melting snow, which would be almost certain to fall upon the lock. When it was thought necessary to clean the bore of the muzzle-loader, the barrel was taken off the stock, a tight swab was fitted to the worm of the rod, then with a basin of hot water the barrel was thoroughly swabbed, clean water was run through, and then a dry swab was applied. Last but not least, the barrel was placed vertically on a hot stove, with breech down, until dry. This process applied to both the percussion and flint lock and carried with it a double purpose. It removed all residue from the bore and also prevented a caking in the breech which, if not attended to occasionally, would entirely close the breech cavity and shut off the fire contact from the priming. I have seen this caking so hard that, after removing the breech plug, a hammer and punch were necessary for its removal. But here I will add that this accumulation was

largely due to the use of a rod that was too short in the regular swabbing with grease, which followed each shot fired, as it failed to reach the lower extreme or breech and a crust formation would follow. In loading a muzzle loader, great care must be exercised. The rifling must be kept from fouling, and should be swabbed after each shot with soft tallow or an equivalent. The swab moistened with water can also be used, but care must be taken to insure the perfect drying of the barrel before putting away.

A conclusion on the quantity of powder to be used should be reached by actual experiment; when found satisfactory, a suitable gauge should be made and used regularly. A very

EARLY FLINT RIFLE CONVERTED TO THE PERCUSSION PRINCIPLE.

good rule to determine quantity of powder can be found in the following way: Place the ball in the palm of the hand, close fingers to about half shut, pour the powder until it just covers the ball. This will not be far wrong; at least it is a very good approximation.

In loading the percussion rifle, great care must be exercised to secure reliable ignition so as to prevent misfires. First the barrel must be swabbed, then the muzzle placed to the lips and blown into. If it is found to be clear, pour in the charge of powder. If it seems clogged, use a common pin in the nipple. If still clogged, put a cap on the nipple and snap. This will mostly bring results. The same process will also apply to a flint lock. In pouring the powder into the barrel, the rifle should be held as near vertical as possible, thus preventing the powder grains from adhering to the greasy bore, causing a slight fouling and possible waste in the process of seating the ball and patch on the powder. The importance of this method is emphasized by the fact that with the old match rifles in both flint and percussion there would be found included with the accessories a small funnel. In fitting the ball and patch to the bore, the ball must be cast of pure soft lead, and to a scant bore diameter—never tight. In fact, it should be loose enough to drop through when the bore is very clean. The patch should be of new linen, well greased with soft tallow. The ball should slide down the barrel with the pressure of one hand. If found to be too tight, a lighter weight linen should be tried. The patch must be cut round or nearly so, just large enough to fold and cover the ball. Center carefully over the bore, ball with sprue or casting core up. See that the ball is nicely dressed after casting. Be very careful that the ball rests on the powder. Give it a few light taps, for if not properly seated, serious consequences will follow—a burst barrel, for instance. Always load with *black powder*, FFG or FFFG. Never attempt to use smokeless in a muzzle loader!

BY careful measurement we learn that a certain percentage of the molds for the muzzle loader were not perfectly round and doubtless this fact would account for a large number of failures in accuracy with the muzzle loader. The early flint rifle was large of bore and would average about a caliber .46, nearly twenty per cent being straight cuts. By 1820 the calibration had been considerably reduced and during the percussion period, from about 1835 to 1875, a still smaller bore average prevailed but, as an average, caliber .42 would be a conservative estimate. This reduction was probably due to two causes. First, the decrease of big game and the corresponding lessening demand for a heavy ball. Second, a better grade of powder with its higher velocity, plus a greater shocking power. The question has often been asked, was the old muzzle-loader a killer? Yes, it was a deadly gun, for it must be borne in mind that the old time hunter when in pursuit of big game used a heavy charge of powder and with the round blunt bullet with a minimum muzzle velocity of not less than 1700 feet per second. This I know from observation. It was a hard hitter and shot very flat up to 150 yards. It was the arm of the pains-taking American pioneer hunter whose motto was "one hit is better than a thousand misses."

This narrative will be closed with a note of human interest which illustrates the prowess of our American ancestors and their rifles during the period about which I am writing. I take the case of Meredith Wolf of Tennessee—a grand old man of the rifle. Mr. Wolf was born in 1832 and enjoys the distinction of having been acknowledged as one of Tennessee's greatest offhand rifle shots and one of America's very best. The incident related shows the prowess of another generation of Americans—a declining characteristic which every lover of the rifle must regret. The story is told that in 1852 Mr. Wolf went to Missouri to match his skill with the riflemen of that state. Rifle shooting was then our national pastime and beginning late in the fall when the farm work was done shooting matches were held with regularity until pressure of work with the coming spring demanded that the rifle be laid aside. On this occasion Meredith Wolf was matched against many of the big shots but he secured a large number of prizes and attracted so much attention that Missouri's best shot was brought forth to meet him and a match was arranged between these two great riflemen. The distance to be fired was 20 yards; the targets were tacks driven in a board; the prize a slave, each rifleman being backed by an admirer who would risk a slave on the outcome. The match was greatly advertised and on the day specified a vast crowd assembled to witness the event. To hit a target the size of a tack head at 20 yards is a task at best even when there is no audience to affect the eye or hand of the exhibitor. But both riflemen were equal to the task and when both had finished their ten shots 20 tacks had been driven through the board. On the eleventh shot the Missourian failed, the ball merely clipping the edge of the tack head. Meredith Wolf stepped to the front with one question doubtless running through the minds of every onlooker. Could he stand the strain? With his long rifle raised, arm fully extended, a vice-like grip, a short interval, the whip-like crack of the muzzle loader and the suspense was ended. The eleventh tack was driven through the board. The Tennessee rifleman was the winner of another match and his admiring backer the owner of another slave.

Curve-Plotting the Art of War

"The More It Changes, The More It Is The Same"

By Oliver Lyman Spaulding, Jr.*

THERE are to be no more wars. At the opening of our latest—shall we say our last?—war, we remembered our former successes, but we had not allowed for our possible enemies' increases in strength and in speed. We thought, or perhaps it is better to say we felt, that we could call to arms, over night, the victorious armies and navies of the past. We did do so; and they achieved their ancient victories again, but at a cost of time and effort that we had never imagined.

The war at last over, we decided that war must never happen again. Our late enemies were perfectly helpless. Their great commander had personally gone before his government, admitted defeat and advised peace. In the final settlement, our enemy was stripped of all her territory except her own home provinces; a crushing indemnity was imposed upon her; she was compelled to give up her entire navy and all her heavy war material; she was placed under such restrictions as would effectually prevent her from engaging in war without the consent of the victors. Buffer states were set up about her. We adopted as a definite policy the self-determination and autonomy of peaceful peoples, the economic isolation of recalcitrants. War is impossible.

Why, then, do we still hear talk of the next war, and why do armaments continue to exist? Because the facts just stated have nothing to do with modern Europe and the late war with Germany. It is the statement that might have been formulated by a Roman citizen, of the situation in the Mediterranean world at the close of the Second Punic War, about 200 B. C. The power that had rested secure in the memory of her past victories was not America; it was Rome, who disbanded her legions according to ancient custom at the end of the First Punic War, only to feel the humiliation of invasion, and to see a foreign enemy at her very gates for years, before she could gain the strength to take the offensive. The defeated general who called for peace was not Ludendorff, it was Hannibal; he addressed not the German Reichstag but the Carthaginian Senate. It was not the German colonial empire that fell, it was that of Carthage. The buffer state was not Poland, not Czechoslovakia, nor yet Belgium nor Luxemburg; it was Numidia, interposed between the shrunken Carthage and her former dominion of Spain, now a Roman province. The provisions outlined were not from the treaty of Versailles, but from the peace imposed by Rome upon Carthage. That they became a settled policy is seen from the similar terms imposed later upon Syria and Macedon.

A distinguished military writer, with much personal experience of war, has pointed out that "the means of destruction are approaching perfection with frightful rapidity." He mentions some of the new weapons, which, he says, "will multiply the chances of destruction, as though the hecatombs of the battles of the recent wars were not sufficient to decimate the European nations." He urges that the governments must combine in a congress to proscribe these inventions; failing this, the only solution of the problem in the use of armor.

But this was not an echo of the Hague and Versailles agreements and discussions as to the use of gas and submarines; it had nothing to do with the Geneva disarmament conference; the writer was not Lord Davies, contending that all new types of armament developed since 1914 should be prohibited to any separate nation, and retained as a monopoly of the police force of the League of Nations; it was not General Fuller, contending for the mechanized force, for the armored motor car and for the tank. It was the Baron Jomini, who said it in his "Art of War" in 1836.

War is eternally being revolutionized. Almost any officer of twenty years' service, at any given time, can recall at least one such revolution. But such revolutions are to be looked upon with a little suspicion. Colonel Azan, one of the French officers sent to America at the time of our entry into the war with Germany, wrote at that time—"From time to time military critics have announced the passing of a new milestone in the evolution of tactics; it was only the milestone which their intelligence had passed." When the smoke has cleared away, we generally find that the revolutionizing weapon has brought a counter-revolution in means of defense. The two cancel out, and things are much as they were before. "The more it changes, the more it is the same thing."

OUR present civilization seems based largely upon analytic geometry. To study the progress of a Panama Canal or a business depression, we deduce an equation and plot a curve. So now, in the matter of the changing art of war, it may be at least interesting to plot a few points. If we find it impossible to bring these points within the relations of any equation, we may have to admit the revolution idea; but if they are such that they may be joined by a smooth curve, we have evidence to substantiate the theory that there are fixed principles somewhere within the confusion of change. Possibly by this process we may even get a test for proposed changes. If there is a clean curve of progress up to a certain point, and the next point does not satisfy the equation of that curve, possibly the point is like the occasional shot which analysis of a series indicates as erratic; in that case, perhaps the new idea is unsound.

There is a considerable mass of data, some of it dating back 2300 years, for determining the coördinates of back points. Some of the writings into which we shall dip are special treatises, dealing with specific military subjects. Some of the more interesting ones, however, are much broader in scope, resembling somewhat closely the modern type of Field Service Regulations. It is these from which our more extended quotations will come.

Works on military history will, for present purposes, be generally disregarded. One can not, of course, fail to mention Xenophon, whose *Anabasis* is so rich in tactical lessons that Wolfe of Quebec fame drew upon it in planning his troop organization, and whose march tables are as businesslike as our own. But he wrote many other works, two of which come strictly within the field of technical military treatises, to which field we are now seeking to confine ourselves. One of these is

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the little sketch of the duties of the captain of cavalry—probably written for his sons, good soldiers both of them, one of whom met a soldier's death on the battlefield. It is the prototype of that popular class of military books, with titles like "Letters of an old Cavalryman to his Son." The other is the pamphlet on horsemanship. Xenophon refers to an earlier treatise on the subject; but it is lost to us, except for brief fragments, and Xenophon's should be of interest to our Mounted Service School as the oldest textbook of their art. It is available not only in the original but in good translation.

It reads much like our textbooks today. As is proper, he opens with a discussion of conformation and soundness; and, like a true horseman, he notices first the hoofs, saying, almost literally, "no foot, no horse." He demands sloping pasterns and plenty of bone in the legs, and tells why; then describes the chest, neck and head, tells what to look for in the jaw and nostrils, and passes on to the back, croup and hind legs. He explains how to tell age by the teeth, talks about hard mouths, and gives tests for proper breaking. He is strong on stable management, discusses grooming and washing, and gives instructions for the construction of stall floors. He explains seats, gaits and aids; he does not go into the *Haute Ecole,* but there is little that we can do with a blanket, surcingle and snaffle only—the sum total of the Greek equipment—that Xenophon does not tell us. Bits and bitting receive his careful attention. His horsemanship is distinctly military, and he goes thoroughly into military equipment and the use of arms mounted.

WORKS touching upon fortifications and siegecraft are numerous. One of these writers, Aeneas, was contemporary with Xenophon (early Fourth Century B. C.). But at that time the Greek, primarily a field soldier, knew little of sieges; that knowledge came to him later in that century, when Philip and Alexander in the east and the rulers of Syracuse in the west had fully absorbed the art from the Semitic races, which seem to have developed it first.

Before leaving Aeneas, however, we may refer to his chapter on signals and ciphers. Not long ago a book on cipher work described in some detail an intercepted cipher message, which consisted in a peculiar method of winding threads through the teeth of a comb, so that it looked like a meaningless tangle. The book claimed, with some justice, credit for the particular organization concerned for ingenuity in deciphering the message; but the system used was exactly one of those described by Aeneas. Absolutely the only difference was that he used a notched bone instead of a rubber comb.

About 200 B. C. we find a most noteworthy treatise on fortification—that of Philo of Byzantium. He is as emphatic as any modern in his insistence that the works must be planned to conform to the ground; a commonsense requirement which has sometimes been neglected by enthusiastic engineers seeking regularity of design. Work does not terrify him; he speaks in a matter-of-fact tone of walls thirty feet high and ditches a hundred feet wide. He faces the foot of his stone walls with earth, to protect against projectiles and battering rams; and he provides iron shutters for his embrasures. He builds his curtain walls in short lengths, with angular traces—the *cremaillère* apparently one of his favorites—and with towers at the angles to flank the faces. He discusses with discrimination the design of these towers, to eliminate dead space. He builds small outworks to protect his gates, and provides detached forts, palisades and obstacles of all kinds to break the cohesion of an attack.

Having built his fortress, he discusses attack and defense. Among the means available to him are not only the rams and the movable protective shelters of the attack, the dropped stones and the boiling water of the defense, but genuine high-power artillery.

His chapters on heavy ordnance are even more highly technical than those on fortification. He explains the classification of artillery weapons according to the shape of the trajectory, and takes up in turn those designed for flat and curved fire—what we usually speak of as the catapult and ballista, although he uses a different set of technical terms. The one type, corresponding to our gun, fired arrows or even heavy timbers; the other, the howitzer of the period, threw stones high in the air. The designs, of course, differed radically, but both depended as a rule upon the twisted hair rope as a propelling power. Philo goes into much detail on construction, with mathematical formulae and computations of dimensions. He seems to have been something of an experimenter and inventor himself; for after describing his service types he gives space to several experimental weapons, some of them of his own design. In one of these steel springs take the place of the twisted hair ropes; in another, compressed air cylinders. Still another, mentioned as a curiosity, is an automatic loading catapult, in which arrows are brought one by one, by suitable gearing from a magazine into the firing position. There are several other books on military engineering and ordnance. One of these, by Vitruvius Pollio, of Caesar's corps of engineers, gives us a hint as to methods of adjustment of torsion artillery. The author remarks that the engineer in charge of these weapons should have a good ear for music; for, if the two driving ropes are not so twisted that they sound the same note, the gun will not shoot true. Obvious, when stated, but the modern would never think of it.

Drill regulations are to be found in abundance; they show us in great detail the commands and means for the maneuver of the Greek phalanx and of the Roman legion. The earliest of these drill masters is Asclepiodotus, who wrote in the first century B. C.; later conspicuous writers in the same fields are Aelian and Arrian, who lived in the second century A. D.

Arrian deserves mention also as a military historian. His *Anabasis* of Alexander is one of our chief sources for the campaigns of that great captain. We pause to mention it here, only to note his analysis of the writings of certain eye-witnesses, available to him but now lost to us. This analysis discusses their competency and credibility, and shows us that critical evaluation of historical material was attempted by the military historians of that day with no less intelligence than by some in our own times.

BUT returning to our drill regulations, we may note first that the theory of military commands was fully understood. The necessity for a preparatory command and one of execution was appreciated, as was also the distinction in nature between them. "Commands by voice," says Asclepiodotus, "must be short and unambiguous. This would be attained if the particular command should precede the general, since the general are ambiguous. For example, we would not say 'face right,' but 'right face;' so that in their eagerness some may not make the turn to the right and others to the left, but that all may do the same thing together."

The drill of the phalanx was based upon a tactical unit about the size of our war-strength company—nominally 256 men, which would give a solid square of sixteen men on a side. The front and depth occupied by each man was in open order two paces, in close order one pace; in the order "with locked shields" the men were jammed as tightly as possible, "fore and aft and 'thwartships." This formation was regarded, not as successive ranks, but as parallel columns of files; each file was carefully organized, with something corresponding to noncommissioned officers at front and rear and in the middle, and with first-class privates alternating with newer men throughout. To change front, the leader of the base file led it "column right (or left)," file length, and halted; the other files in succession conformed to the movement. To reduce the depth, each alternate man stepped up abreast of the man ahead; to reduce again, intervals were extended and the process repeated. Facing the resulting formation to a flank gave the march column.

Front could be made to the rear by a simple about face; the second ranking noncommissioned officer, normally posted at the tail of the file, then acted temporarily as file leader. It was possible also to make the change of front by a countermarch, as is done now by a military band; this brought about no change in file leaders, but of course placed the original left file on the right. A countermarch by rank was provided, as well as the one by file; execution of the two countermarches successively restored the normal relation of right and left in the reversed phalanx.

A double phalanx could be formed, by facing the rear half of the formation to the rear; with this maneuver in mind, noncommissioned officers or first-class privates were posted as the two middle men in the normal file. This maneuver might be made either as an offensive or a defensive measure. If for passive defense against an attack in rear, the rear half-phalanx was marched a bowshot to its new front, so that "overs" on one half would not be effective on the other. If for maneuver, either offensive or defensive, the two half-phalanxes, marching by the flank, could form a new line of double length, with either a salient or re-entrant angle. Ranks and files were kept open whenever possible, for the convenience in maneuver; for close combat units were marched by the flank, closing all intervals between them, and ranks and files closed solidly. Several lines of pikeheads were thus brought to stand in front of the first rank of men.

The Roman legion was maneuvered on the same principles, but the legionary was not a pikeman, and so never formed a phalanx. The ten cohorts of a legion, some five hundred men each, were formed in compact little bricks of men, but with front greater than depth. The cohorts were disposed in several lines, usually three, those in rear habitually covering intervals in front. Advance was slow until close to the enemy; then the front ranks took up the run, each man threw his two javelins, drew his short thrusting sword, and all opened out to two paces interval, covering the cohort intervals and forming a continuous line of swordsmen across the front of the legion. The rear ranks of the front line cohorts reinforced this line continuously, each rank first throwing javelins over the heads of the men already engaged. The second and third line cohorts acted precisely as do our supports and reserves now.

We have an excellent analysis and comparison of the Greek and Roman fighting methods, by no less a person than Polybius, the military historian. No one could have been more competent than he to make such a comparison—an experienced Greek officer, who spent the latter part of his life in Rome, residing with the Scipio family and accompanying the second Scipio Africanus in his campaigns.

WE often find, in our current military literature, sketches of what a general should be—what are the desirable and undesirable qualities for him. This is especially a favorite subject for lectures in our military schools. Anyone wishing to prepare such a lecture will find an ample store of material in the ancient writers; in fact, directly or indirectly, all such lectures draw their material thence, and few of them find anything new to add. The first noteworthy studies of this kind date from the first century A. D., when Frontinus, a Roman general, and Onasander, a Greek philosopher, both tried them.

Each wrote according to his nature and training. Frontinus was a practical soldier, and something of an engineer; his last service was as water commissioner of Rome, and he has left us an excellent description of the aqueduct system. But as a result of his field campaigns he wrote two books. One was a general treatise on the art of war, which is lost; the other was a supplement to it, containing over four hundred historical examples, each intended to emphasize some particular point as to the character or technique of a general. Many of these are mere anecdotes, with little claim to authenticity, but others are more apt and convincing.

Onasander, the philosopher, starts at the other end. He first draws a picture of what a general ought to be, in character, temperament and training. Then he places this ideal general in a great variety of military situations, and considers how he ought to proceed.

Others had done such work before, in fragmentary fashion; in fact, Xenophon himself may have served as an inspiration, for his "Education of Cyrus," a sort of military allegory, draws the picture of its hero as Xenophon would have wished him to be, and then uses the narrative as a vehicle for the author's military theories and fancies. But Onasander is the first, of a long line of writers, to construct his whole work on this plan, and we can read Onasander in the regulations of many countries and hear him in the lectures of many school commandants to their successive classes.

THE first notable effort, at least the first surviving effort, to compile a work comparable to our Field Service Regulations, was by one Flavius Vegetius, who lived in the fourth century of our era. Nothing is known of him personally, but it appears from his work that he was a man of rank, and probably a theoretical rather than a practical soldier. His work, "Epitome of the Military Art," is dedicated to the reigning emperor, probably Theodosius the Great or Valentinian III, and purports to have been written at his command. The writer claims no originality—insists, in fact, that his work is a compilation. He mentions among his chief sources the regulations of the Emperors Augustus and Hadrian, and the treatise on the military art by Cato the Censor, all of which are now lost. He is distinctly a conservative, and defends the old Roman system as developed under the earlier emperors against the intrusion of foreign doctrines and against the indifference and neglect of a degenerate age.

Book I treats of recruitment and elementary instruction. The writer insists upon thorough training and strong discipline: "a small trained force is the best guarantee of victory;

a raw undisciplined host is doomed to slaughter." He outlines a plan of physical training for recruits—running, leaping and swimming. Cavalry recruits are trained on a wooden horse, to mount by vaulting from either side, fully armed and equipped; an important and practical exercise, for stirrups were then unknown. Great pains were taken with instruction in the use of arms—the javelin, the sword and the bow. The swordsman was taught habitually to thrust, not to cut, and the reasons are here explained as in modern cavalry drill regulations. When individual instruction had progressed to a certain point, the elements of collective training were taken up, especially marching. A fully instructed recruit was expected to be ready to join in the practice marches of his cohort, made every ten days—twenty miles in a day, over varied ground, in full kit, with incidental exercises in minor tactics. He was expected also to know how to do his share in the work of entrenchment; for the writer holds to the old Roman plan of entrenching every camp. The trace of the camp wall is determined by the nature of the ground; a rectangle is generally preferred. The capacity of the Roman for spade work is indicated by the dimensions which our author gives; a wall three feet high, with a ditch nine feet wide and seven feet deep, is regarded as a light entrenchment. For a really serious case, the ditch is to be twelve feet wide and nine feet deep, the wall four feet high, revetted with hurdles and crowned by a palisade—for the wall is not a breastwork, and its broad flat top is the terreplein upon which the defenders stand. The organization of the work also is explained; the cavalry forms an outpost, backed up by half the infantry, while the other half forms the working party. Reliefs are made by complete small units, under their own officers; in the process of the relief the officers in immediate command measure the work done, to fix responsibility.

The book ends with the pithy remark: "Military instruction should always be given to selected young men; for the state will find it less expensive to train its own citizens in arms, than to purchase foreign assistance."

BOOK II treats of organization and interior economy. It describes, in opening, the two great classes of troops of Rome —the legions, the regular troops of the central government, and the auxiliaries, or provincial contingents. The author explains the great assistance that such auxiliaries may give to the legions, but points out a difficulty which is not unfamiliar to us; namely, that when one class of troops has stricter discipline and heavier duty than another, recruits will avoid the first and seek the second. He laments the decay of the legionary forces, as a result of failure to make service in them attractive.

A brief sketch is given of the paper work of the legion—pay accounts, duty rosters, furloughs, deposits of pay, administration of a legionary relief fund. Additional instructions follow on collective training; all subjects mentioned for recruits are continued in the troop units, newly incorporated recruits attending two drills a day, old soldiers one. A brief description is given of the legionary train; aside from regular supplies, it included artillery—heavy for the legion, light for the cohorts, just as we provide machine guns for our battalions and heavier accompanying weapons for the regiment. It included also an engineer train, with ponton and entrenching equipment, and also mobile workshops of various kinds.

Book III is the real Field Service Regulations. It begins by discussing the desirable strength of an army, and lays down the rule that quantity should not be sought at the expense of quality; that a smaller trained force is preferable to a larger one, loosely organized and ill disciplined, which consumes supplies out of all proportion to the service that it can render. After the long reign of the great "nation in arms" theory, our modern world seems to be tending to a return to Vegetius.

The next place of honor is given to sanitary regulations. Rules are laid down for the selection of a healthy camp site; the suggestion is made that in hot weather marches should begin very early, so that they may be terminated before the hottest time of the day. Stress is laid upon ample and pure water supply; upon prompt medical attention and proper diet for the sick; and upon frequent moving of camps.

In the matter of supply, the writer calls for careful preliminary estimates of requirements, proper apportionment of requisitions to the provinces that are to fill them, and logical organization of depots. The subsistence stores mentioned are beef on the hoof, grain, wine, vinegar and salt; fuel, forage, arms and ammunition are not neglected. Discipline is discussed, so are methods of visual and sound signaling.

MUCH space is given to the service of security and information, to marching, and to minor tactics. A knowledge of the country is mentioned as vital; reconnaisance should be constant, and reconnaissance reports should be accompanied by sketches. Other points treated as important are the procurement and treatment of guides; the formation of march columns, with advance and flank guards and appropriate disposition of trains; careful calculation of space and time; and close supervision of march discipline by officers. A special section is devoted to river crossings—the reconnaissance of fords and the technique of using them; the construction of ponton bridges; and the establishment of bridge heads.

Camps are discussed at some length. The engineers are cautioned as to accurate estimates of space required. Methods of fortification are explained more fully than they were in the earlier part of the work, and regulations are given for outpost and interior guard duty.

For planning a campaign and selecting ground for battle, a form is given for an estimate of the situation, taking into account the nature of the country and the strength and morale of the opposing forces. The proper amount and kind of training during active operations are considered. In battle, the influence of the direction of wind and sun is noted. The various methods of formation of a large force are treated at length; the infantry is placed in the center, in such order as may be appropriate, well organized in depth—for the importance of reserves is noted. Its flanks are covered by heavy cavalry, and the light cavalry operates independently farther out to the flanks.

A number of military maxims are included in the introduction and conclusion of the book, or scattered through it. Among them are noted:

"Who wishes peace, let him prepare for war." "Who hopes for victory, let him be diligent in military training." "No one dares to provoke a power which is known to be superior in war." "A general must not attempt to change his plan or shift troops after the battle has begun: confusion always results, offering opportunities to the enemy."

Book IV treats of fortresses. The author recommends curtain walls in short lengths, with towers at the angles. He discusses supply, especially of water, salt meats, fruits, vegetables and grain; and he insists upon rigid rationing of all stores, both for the military garrison and for the civil inhabitants. Methods

and engines for attack and defense are described at some length. Among the engineering expedients mentioned is our old friend, the measurement of the height of a wall by measuring its shadow, and comparing it with that of a pole of known height.

The subject of Book V is naval warfare. It is very brief and elementary, and calls for no discussion here. The author does not seem nearly as much at home afloat as he does ashore.

IN marked contrast to most ancient military writings, this one never fell into obscurity. This is perhaps due to the circumstance that it is the only comprehensive ancient treatise on the whole art of war, which was written in Latin. Others there were, as we shall see, but they are a trifle later, in an age when Latin had ceased to be the current language of the eastern empire; they were written in Greek, and hence were less known and understood in western Europe. Vegetius was always widely read, copied in great numbers of manuscripts, and translated into all modern languages as soon as these languages had reached a state of development making translation worth while. The leading soldiers of the Middle Ages carried him in their saddle pockets. The earliest printers seized upon him as one of their first texts; half a dozen printed editions appeared before the end of the Fifteenth Century. The Epitome is well worth a little of the time of any soldier; it is available in translation at the War College Library and elsewhere.

Of the Greek treatises mentioned above there is a whole series, evidently closely connected. The first is an anonymous Byzantine work, written in the time of Justinian, the early part of the Sixth Century. The writer was apparently a soldier; very probably an engineer officer, for he seems most at home in writing of technical matters. In field tactics his work reads as if taken from other books, rather than from his own experience. He evidently used Vegetius, but he also used drill books such as Arrian, and his tactics are those of the phalanx, not of the legion.

THE next in the series, and probably the most original and valuable, is the Strategicon, attributed to the Emperor Maurice, who reigned in the Eastern Empire at the end of the Sixth Century. Maurice evidently used both Vegetius and the Anonymous, but he did not copy them; in every chapter appears the practical field soldier, who knew his regulations but was highly enough placed not to be bound by them. He gives us the way things were really done. The book is not well arranged and constructed, from a literary point of view, and the language is not smooth and polished. One can almost picture the old soldier, dissatisfied with the way the "new army" generals were conducting military affairs for him, sitting down to dictate new regulations from his own experience; not seldom he starts a sentence, then thinks of some parenthetical remark, and never comes back to finish the original sentence.

One chapter contains a most excellent discussion, valid even now, of the reasons why troops must be formed in depth —why supports and reserves are needed, and how they are handled. A whole book is devoted to a collection of military intelligence monographs, such papers as might have been compiled from the reports of military attachés, on the military strength and resources, and the methods of fighting, of all the probable enemies of the empire.

Maurice's chapters on military law are interesting; they constitute a complete code of Articles of War. Their origin would be an interesting study, for they are so thoroughly worked out that it can hardly be that they were a new composition—Maurice must have found them already existing. But be that as it may, it seems a certainty that ours are derived from them. The general idea is the same, and in some cases the language of ours is almost a literal translation of his.

He divides his Articles of War into three groups. One, the ordinary peace-time articles, is published informally to each squad upon muster into the service. The second list is similar, but is for officers only; it includes articles imposing certain additional responsibilities upon them, with heavier penalties for failure. The third group is the code of extraordinary rules for the government of armies in the field in war; this group of articles is published with due solemnity to the troops in formation under arms. A few of the articles may be quoted.

"If any soldier shall disobey the orders of a non-commissioned officer, he shall suffer punishment. . . . If any person in the military service shall presume so to act toward the commanding officer of his battalion, he shall suffer death. If any soldier shall be unjustly treated by anyone, he shall appeal to his battalion commander; if by that commanding officer himself, then to the next higher commander."

"If any person in the military service shall, on any pretext whatever, presume to enter into any conspiracy, sedition or mutiny against his commanding officer, he shall suffer death; and more especially any person who shall excite or lead any such conspiracy or mutiny."

"If any person, having been placed on guard in any city or garrison, shall betray the same to the enemy, or shall quit his guard without the authority of the proper commanding officer, he shall suffer the extreme penalty."

"If any soldier, having heard the orders of a noncommissioned officer, shall neglect to comply therewith, he shall suffer punishment; but if he fail through ignorance of the orders, the noncommissioned officer shall suffer punishment for having failed to instruct him properly."

"If any soldier shall find a stray animal, or any other property of however small value, and shall not report it, and turn it over to his commanding officer for restoration to its proper owner, he shall suffer punishment; and not he alone, but any person having knowledge of the facts and failing to report them."

"If any soldier shall, in the face of the enemy, quit the ranks or abandon his colors, or run away, or shall quit the place where he has been posted, or shall plunder the dead, . . . or shall enter into the enemy's trains or camps, it is our order that he shall suffer death, and that any property which he may possess shall be turned in to the common fund of his battalion."

"If a standard shall be captured by the enemy (which God forbid), without just and manifest excuse, it is our order that the color guard shall suffer punishment, and shall be reduced from that dignity and made the last in their own command, or in any other unit to which they may be transferred. But if it shall appear that any of them was wounded in the action, he shall be held exempt from such punishment."

"If any soldier shall throw away his arms in action, it is our order that he shall suffer punishment, for that he disarms himself and supplies the enemy."

The army of Vegetius was an infantry army; cavalry was auxiliary. Maurice wrote at a time when cavalry was the principal arm. He discusses it very fully, and infantry only briefly. His typical soldier is the armored horseman mounted

on an armored horse and armed with both lance and bow. This is noteworthy; the earlier horseman usually had not a lance but light javelins. He could not charge home with the lance, for he had no stirrups. Maurice's cuirassier had them. Apparently they were no longer a novelty, but he could not have had them very long, for this is the earliest known mention of them.

Drill regulations are treated carefully but briefly, and Maurice makes it a special point that he has prescribed no movements that are not useful in the field. But minor tactics are treated at length.

The formation of march columns is analyzed, and the differences between peace and war conditions pointed out. The army is to be kept well separated in friendly country, for comfort and for convenience of supply, but concentrated when nearing the enemy. Regulations are given for the conduct of quartering parties sent ahead, and of engineer detachments laying off camps. Passage of defiles by this heavy armed force was difficult in time of peace, and dangerous in the face of the enemy; consequently, detailed instructions are given for both cases. Provision is made for the detail in each troop unit of men corresponding to our litter bearers; only, instead of using a litter, which would be impracticable for mounted men, each man so detailed rode a special saddle, with a rear seat and an extra pair of stirrups. These men drew specified premiums for each wounded man brought off.

The troops were trained in both close and extended order, to charge in mass or "as foragers," and to combine fire and shock action with the bow and lance. Model formations are given, with normal intervals and distances; the general tactical idea is a frontal attack, with one mobile defensive flank and one strong offensive flank for envelopment. A whole book is devoted to ambuscades—how to lay them and how to meet them. Habitual and extensive use is made of obstacles—trenches like "tank traps," numerous *"trous de loup"*—or military pits—and ancient equivalents of barbed wire.

Maurice treats intelligently the qualities and duties of the general, but he goes into small things with as much interest as into great; he does not forget to caution his officers about times and methods of watering horses, and about seeing that their men have the required rations in their saddle pockets. In this connection, it might be remarked that when troops are going into action, the men are required to carry their canteens filled "with water, not with wine"—anticipating Kipling's dictum that "when it comes to slaughter, you will do your work on water."

He gives a large number of principles of war, or maxims, many of them from Vegetius, including the perennial "if you wish peace, prepare for war." He is a field soldier, and talks chiefly of open warfare, but gives a little space to sieges. He does not omit to mention, here and there, practical points about arrangement and sanitation of camps.

The book seems to have set the standard for ancient field service regulations. In one form or another, it remained in force down to the time of the first crusades. There were at least two revisions and republications of it; one known under the name of the Emperor Leo VI ("the Wise"), at the end of the Ninth Century, the other under that of his son and successor, Constantine VII ("Porphyrogenitus"), in the Tenth. These revisions modified the form of the book more or less, and, especially in the military intelligence monographs, brought it down to date, but made no essential changes in principle.

Military writing did not cease here, but there are no noteworthy books to mention of the kind here in point. The medieval chroniclers were generally churchmen, with little military knowledge. We have reached almost the period of printing, and from that time on military treatises are numerous. This little review must cease, before it becomes swamped with material. We have plotted some points of the curve!

Proof Tests and Proof Marks

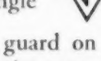
IV: Practices of Manufacturers in the United States

By Calvin Goddard*

IN the United States, no official proof house exists. As a result, it devolves upon each manufacturer to conduct such tests as he may deem proper. Obviously, it is to his advantage to know that his arms are soundly made, for if they are not, and mishaps occur, he will soon find himself facing suits for accidental injury.

In general, caliber .22 rim-fire arms for domestic sale are not proved, but rifles chambered for more powerful cartridges, and shotguns as well, are proof-tested in one manner or another. Pistols and revolvers are ordinarily not subjected to a proof test. The practices of various makers now producing arms in the United States, are as follows (according to reports received from them directly).

Browning Arms Co., St. Louis Mo. (Current products—automatic shotguns; "over and under" shotguns.) The arms marketed by this company are made in Belgium, where they are subjected to the standard Belgian proof tests for weapons of their class, passing which they receive the usual marks of acceptance.

Colt's Patent Fire Arms Manufacturing Company, Hartford, Connecticut. (Current products—revolvers, automatic pistols, single-shot pistols, automatic rifles.) "Each and every-one of our arms sold is tested before leaving the factory, and on both automatic pistols and revolvers will be found our mark—the letters 'V. P.' combined, inside a small triangle  appearing on the upper forward section of the guard on the left hand side. . . ." It is unfortunate that the *nature* of the tests conducted has not been specifically outlined, but their adequacy may be assumed.

Crescent-Davis Arms Corporation, Springfield, Mass. (Formerly of Norwich, Connecticut, now controlled by J. Stevens Arms Company, Chicopee Falls, Massachusetts, which in turn is owned by the Savage Arms Corporation, Utica, New York. Current products—shotguns.) Proof practices—same as for Stevens Shotguns, *q. v.*

Dubiel Arms Co., Ardmore, Okla. (Formerly, Hoffman Arms Co. Current products—single-shot and repeating rifles of high power.) "We do not manufacture complete rifles nor ammunition, all we do is rebuild rifles and we use Springfield, Winchester, Remington and Mauser actions, and the actions have been test proved before we get them, also the ammunition."

Griffin and Howe, New York City. (Current products—single-shot and repeating rifles of high power.)

This firm failed to reply to my inquiry as to their proof practices. Since they use only commercially produced actions, however, the remarks for the Dubiel Arms Co., above, probably apply equally well to their output.

Harrington and Richardson Arms Company, Worcester, Mass. (Current products—revolvers, single-shot pistols, shotguns. This company formerly made automatic pistols also.)

It would appear that this company proves only such arms as it exports to countries under the British flag (although their correspondence is not definite upon this point). These are submitted to a test equivalent to the British proof for similar weapons, on passing which satisfactorily, those going to Australia or New Zealand receive the mark . Guns shipped to other parts of the British Empire are proved, but not marked.

High Standard Manufacturing Company, New Haven, Connecticut. (Current products—caliber .22 single-shot and automatic pistols.)

"Each of our pistols is fired a great many times in the action tests, and in the sighting, and we consider that in a .22 caliber this is sufficient to guarantee complete safety."

Hunter Arms Company, Fulton, N. Y. (Current products—single- and double-barrelled shotguns.)

This company proof-tests its products as follows:

Gauge.	Shell.	Grains FFG Black Powder.	Grains 7C Shot.	Max'm Pressure (Lbs. per sq. in.)
12	3″	226	957	17,500
12	2¾″	178	738	14,300
16	2 9/16″	178	738	13,750
20	2¾″	157	657	14,650
.410	2½″	65	273	15,675
10	2⅞″	260	1094	16,000
12	2¾″	206	875	15,900

It would appear that the pressures achieved should be sufficient to insure the solidity of the arms tested. The proof mark, applied to all barrels of this make, is:

Ithaca Gun Company, Ithaca, New York. (Products—single- and double-barrelled shotguns.)

"Each barrel on every Ithaca gun is proof tested with a load consisting of approximately two loads of powder and a load and a half of shot and this proof load sets up a predetermined pressure of about 40 per cent in excess of the maximum service load."

Proof marks are as follows:

(By special agreement the Ithaca Gun Company, the Lefever Arms Company, and the Western Arms Corporation, all of Ithaca, conduct their proof tests jointly, and employ the same set of proof markings—hence those illustrated will be found on the products of all three of these organizations.)

Iver Johnson's Arms and Cycle Works, Fitchburg, Mass. (Products—single- and double-barrelled shotguns, single-shot rifles, revolvers.)

"We provisional and definitive proof test shotguns, single and double, being governed by the Rules, Regulations, and scales formulated by the Gun Makers Company and the Guardians of the Birmingham (England) Proof House—Scale No. 4, Breech Loading Arms of Smooth Bore. As you undoubtedly know, the procedure is necessary on all shotguns exported to Australia and some other British possessions.

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TABLE A

PROPOSED LIMITS FOR SERVICE AND DEFINITIVE PROOF PRESSURES CORRESPONDING TO CERTAIN SHELL LENGTHS IN DIFFERENT SHOTGUNS

The limits are based on the British Rules and Regulations of 1925 and the Definitive Proof Pressures developed by the specifications, using No. 7 drop shot. Pressures are shown both in pounds and long tons per square inch.

Nominal Gauge	Nominal Chamber and Shell Length	Theoretical Service Pressure Limits Based on Definitive Proof Pressures (See Note B)		Service Working Limits for Factory Loaded Ammunition (See Note C)		Definitive Proof Pressure				
						Load		Pressures Developed		
		Mean	Maximum Individual	Mean	Maximum Individual	Powder in Grains	Shot in Grains	Mean	Maximum Individual	Minimum Individual
10	2-7/8	12000 5.35	14500 6.50	11200 5.00	12000 5.35	260	1094	16800 7.50	18100 8.10	15400 6.90
12	2-5/8	9800 4.36	12000 5.36	9500 4.25	10800 5.00	178	738	13700 6.10	15000 6.70	12500 5.60
12	2-3/4	12400 5.53	15000 6.68	10500 4.70	12000 5.35	206	875	15900 7.10	17500 7.80	15200 6.80
12	3	12400 5.53	15000 6.68	11200 5.00	12300 5.50	226	957	17300 7.75	18700 8.35	16000 7.15
16	2-9/16	10100 4.53	12400 5.56	10100 4.50	11700 5.25	154	656	14200 6.35	15600 6.95	13100 5.85
16	2-3/4	11200 5.00	13600 6.08	10500 4.70	12300 5.50	178	738	15700 7.00	17000 7.60	14400 6.40
20	2-1/2	10400 4.64	12700 5.68	10100 4.50	11700 5.25	136	574	14500 6.50	15900 7.10	13200 5.90
20	2-3/4	11600 5.18	14000 6.28	10700 4.75	12900 5.75	157	657	16200 7.25	17600 7.85	14900 6.65
20	3	11600 5.18	14000 6.28	10700 4.75	12900 5.75	157	657	16200 7.25	17600 7.85	14900 6.65
28	2-1/2	12000 5.35	14500 6.50	11800 5.25	12700 5.65	130	547	16800 7.50	18100 8.10	15400 6.90
32	2-3/4			9500 4.25	10700 4.75	109	465			
410	2			9500 4.25	10700 4.75	55	219			
410	2-1/2	12400 5.53	15000 6.68	9500 4.25	10700 4.75	65	273	17300 7.75	18700 8.35	16000 7.15

NOTE A—Definitive Proof Pressures are given even values in this table. NOTE B—These theoretical mean limits set to allow a 40 differential to mean Definitive Proof, while the theoretical maximum individual limits were set to allow a 25 differential to maximum individual Definitive Proof Pressures. NOTE C—These limits were set to conform to the maximum requirements previously reported by any one of the leading companies. It is recognized that these limits, in some cases, are higher than consistent with good results under normal conditions and that some companies do not load to as high limits but they are intended to cover all variations.

We give the Definitive Proof Test to all of our .22 caliber rifles and .22 Supershot Sealed Eight Revolvers."

Iver Johnson proof marks are as follows:

Provisional Proof: Definitive Proof:

Ⓟ IP

Lefever Arms Company, Inc., Ithaca, N. Y. (Current products—single- and double-barrelled shotguns.) Proof practices same as for Ithaca Gun Co. *q. v.*

Marlin Firearms Company, New Haven, Conn. (Current products, cal. .22 and high power repeating rifles, repeating shotguns. Formerly made revolvers.)

"The following are the proof loads we use in testing our guns."

12 ga.—4¾ drams Dupont Lightning Smokeless Powder—1¾ oz. shot
20 ga.—3 drams Dupont Lightning Smokeless Powder—1¼ oz. shot
25/20—10 drams Dupont Lightning Smokeless Powder
32/20—13 drams Dupont Lightning Smokeless Powder
30/30—25 drams Dupont Lightning Smokeless Powder

Their proof mark consists of the letters J. M. in an oval, thus: ⒿⓂ

O. F. Mossberg and Sons, New Haven, Connecticut. (Products—caliber .22 rifles; .410 gauge single and repeating shotguns; repeating .22 caliber pistols.)

This firm proof-tests, in accordance with British proof regulations all rifles shipped to England or its dominions, the latter accepting certificates to the effect that the arms have been proved in conformity with British regulations. Proof mark consists of the single letter "P."

Their .410 gauge shotguns are proved at 13,000 pounds pressure. Proof mark is in the form of a P surrounded by a circle: Ⓟ

Parker Brothers, Meriden, Connecticut. (Products—single- and double-barrelled shotguns.)

"Parker Brothers, as members of the Institute of Small Arms and Ammunition Manufacturers, have subscribed to and are following the rules of proof testing set up by the Institute. These rules are practically the same as those of the London and Birmingham proof houses. . . ."

So far as I am aware, the only difference in the method of proof testing Parker Guns and others is that ordinarily definitive proof is done while the barrels are in the white. Parker Brothers, however, defer definitive proof until the barrels are fully completed, finally bored, and browned, so that when the proof test is made the barrels are entirely

TABLE B

Loading Data for Definitive Proof Loads

Nominal Gauge	Nominal Shell Length	Definitive Proof Load		Over Powder Card Wad		Capsule Wads			
						Under Shot		At Front End	
		Powder in Grains	Shot (No. 7 drop) in Grains	Thickness	Diam.	Thickness	Diam.	Thickness	Diam.
10	2–7/8	260	1094	.050	.782	3/8"	0.756	3/8"	0.686
12	2–5/8	178	738	"	.739	"	0.686	"	0.632
12	2–3/4	206	875	"	.739	"	0.686	"	0.632
12	3	226	957	"	.739	"	0.686	"	0.632
16	2–9/16	154	656	"	.677	"	0.632	"	0.592
20	2–1/2	136	574	"	.634	"	0.595	1/4"	0.570
20	2–3/4	157	657	"	.634	"	0.595	"	0.570
20	3	157	657	"	.634	"	0.595	"	0.570
28	2–1/2	130	547	"	.547	"	0.525	"	0.419
32	2–3/4	109	465	"	.512	"	0.419	"	0.370
(36) 410	2	55	219	"	.412	"	0.370	3/8"	0.370
(36) 410	2–1/2	65	273	"	.412	"	0.370	"	0.370

Powder—Black Powder is recommended, granulation: FFFg, specific gravity: 1.82 ± 0.02.

Shot—Is loaded in rolled paper capsules with felt wads at each end of the sizes listed. This capsule should be held in the shell either by glue or shellac.

finished and no more material will be removed by any subsequent operation.

The Parker proof mark, which is rolled upon the flat or water table of each tube, is as follows: OVERLOAD PARKER BROS PROVED

Remington Arms Company. Arms Plant, Ilion, New York. Ammunition Plant, Bridgport, Connecticut. (Current products—single-shot and repeating rifles, repeating and automatic shotguns, "over and under" shotguns, automatic rifles, double derringers, metallic ammunition and shot shells—formerly made revolvers and automatic pistols.)

"All shotguns and highpower rifles are proved according to the definitive English proof.

"Domestic small bore rifles, such as .22 caliber, etc., are not proved, only on customer's request. All export guns are proved. After proof, our guns are then tested a number of rounds with the regular service ammunition. All guns which have been proved bear the mark: R.E.P.

"This designates, 'Remington English Proof,' and will be found stamped on the breach end of the barrel."

Savage Arms Corporation, Utica, New York. (Current products—single-shot and repeating rifles, repeating and automatic shotguns. Formerly made automatic pistols.)

"It is the practice of this company to subject shotgun barrels and rifle barrels to a *provisional proof test* to the unfinished barrel. After the barrel is finished, it is given a final definitive proof with a proof load developing from 30 per cent to 35 per cent above normal. The barrels are then stamped with our proof test stamps as shown." These are (for shotguns): SAP and (for rifles): SP

R. F. Sedgley, Inc., Philadelphia, Pennsylvania. (Current products—caliber .22 "Baby Hammerless" revolvers, high power repeating sporting rifles, signal pistols, gas pistols, fountain pen pistols (for .22 R. F. ammunition) caliber .22 adapters (for .38 and .45 auto pistols). Formerly made .32 hammerless revolvers.)

"All of the rifles that we are putting out are proof tested with a 50 per cent overload, and every barrel so proved is stamped with our proof stamp, which is an S in an oval: S

The rifle is then shot with commercial ammunition, the shells being carefully examined for chamber marks, after which the metal work is finished up and blued, and again tested and shot in, the second testing not being as heavy as the original proof test."

Smith and Wesson, Springfield, Mass. (Current products—revolvers and automatic pistols.)

"The present revolver ammunition as manufactured by any of the ammunition companies may be accepted as standard for use in our arms, and for proof loads we will accept 50 per cent increase over the standard.

"Insofar as our regular run of arms goes, they are merely fired with standard loads, but this is merely to check up functioning and with no idea of proofing."

Sporting Arms and Ammunition Manufacturers' Institute, New York City.

The nearest approach to an official proof house in the United States is the Sporting Arms and Ammunition Manufacturers' Institute, with headquarters in New York City. This organization, composed of some 15 of the most prominent makers of arms, ammunition, and explosives in this country, has undertaken, of its own volition, to establish proof tests, standardized pressure gauges, uniform chamber sizes, etc., along the lines followed by the Permanent International Commission on Small Arms overseas.

Proof specifications, as adopted by this Institute and voluntarily followed by its members, appear in Tables A and B.

J. Stevens Arms Company, Chicopee Falls, Massachusetts. (Current products—single shot and repeating caliber .22 rifles.

Single shot pistols. Single, double, and repeating shotguns. Formerly made high power sporting rifles.)

"All of our shotgun barrels are tested with a proof load developed for us by the Remington Company. This load does not have quite the same characteristics as the old black powder proof load which was based on English proof house requirements.

"The proof load we use is different in that the pressures are not sustained as uniformly through the same distances in the barrels as the black powder proof loads. However, the initial breech pressure is higher and the drop in pressure as the charge progresses through the barrel still leaves a pressure amply sufficient to prove the strength of the barrel.

"All of our shotgun barrels so tested are stamped with the initials of the inspector making the test and the letters 'P. T.' For example, 'A. M. P. T.,' 'A. M.' being the initials of the inspector and 'P. T.' standing for proof test. This stamp is placed on the barrel lug."

"On our caliber .22 rifles, some of our older models are not adapted for use with the new caliber .22 high speed ammunition, and any of these models now leaving the factory have the barrels stamped "Regular cartridges." Rifles now leaving this factory which are suitable for use with this high speed ammunition are not marked "Regular cartridges." These models are tested with caliber .22 ammunition furnished us by Remington, which we understand developes pressures about 10 per cent in excess of the high speed cartridges that are now sold commercially."

Western Arms Corporation, Ithaca, N. Y. (Current products—double-barrelled shotguns.) Proof practices same as for Ithaca Gun Co., *q. v.*

Winchester Repeating Arms Company, New Haven, Connecticut. (Current products—single-shot and repeating rifles, double-barrelled and repeating shotguns, metallic cartridges and shot shells. Formerly made automatic shotguns.)

"Winchester barrels are proof shot in the rough before completely finished, the proof known as provisional, and again as a completed gun, known as definitive. The standard laid down for the British proof regulations adopted by the Guardians of the Birmingham Proof House dated 1925 is followed."

The Winchester proof mark (found on barrel and frame) is as follows:

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17. Correspondence with arms makers in the United States, 1933.
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EDITOR'S NOTE—Publication at this time of the above reference bibliography is not to imply that the above article concludes Colonel Goddard's remarkable series on "Proof Tests and Proof Marks." Thus far he has described practices of the British companies (in the November-December issue, 1933), those of the Continental companies (January-February and March-April, 1934, issues) and the above article on practices in the United States. The concluding article of the series, on which the author is now at work, will describe the practices and marks of the U. S. Government. It is hoped that it will be ready for publication in the next issue of ARMY ORDNANCE. If not, readers may rest assured that it will appear as soon as the research by the author is completed.

ARMY ORDNANCE

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Month by Month

Our New General Officers

In 1930 when Maj. Gen. Samuel Hof was appointed Chief of Ordnance of the Army for a term of four years we called attention in these columns to the unusual significance of the occasion. It was unusual because prior to that time there had been only two officers of our Army who, over a period of 28 years, had received this distinction. General Crozier, it will be remembered, served as Chief of Ordnance from 1902 to 1918 and General Williams from 1918 to 1930. These two officers attained such renown for the Ordnance Department of the Army that their names are synonymous with efficiency, ability and accomplishment in our military annals.

The present transfer of the Ordnance scepter is more unusual in some respects than was the change in command in 1930. Now we have a Chief of Ordnance joining the ranks of ex-Chiefs and, in one fell swoop, a new Chief of Ordnance and two new brigadier generals as Assistants to the Chief. General Hof will complete his term on June 2, 1934, when he will be succeeded as Chief of Ordnance by Maj. Gen. William H. Tschappat, who is at present an Assistant to the Chief of Ordnance in charge of the Manufacturing Service. General Tschappat will be succeeded by Brig. Gen. Herman W. Schull who will leave his post as Commanding Officer of the Rock Island Arsenal to assume the duties as an Assistant Chief and as head of the Manufacturing Service on the day when General Tschappat becomes the Chief of Ordnance. On September 1, 1934, when the term of Brig. Gen. Edwin D. Bricker, who is Chief of Ordnance Field Service, will expire he will be succeeded by Brig. Gen. Edward M. Shinkle who is now Commanding Officer of the Aberdeen Proving Ground. All this resolves itself as follows:

It is our privilege to greet the new appointees on behalf of the Army Ordnance Association and at the same time to express some measure of the appreciation that is ours to Generals Hof and Bricker upon their relinquishment of office. So far as the new appointees are concerned, we extend here a hearty welcome to each of them and voice the belief that the Ordnance Department itself and its several major functions could not be in more competent or more willing hands. Moreover we propose to dedicate, after a fashion, this and the two succeeding issues of Army Ordnance to our new Major General and our two new Brigadiers. The frontispiece in these issues will be given over to photographs of the respective generals and in these columns record will be made of their services and of our felicitations. This, then, is dedicated to our new Chief of Ordnance.

General Tschappat needs no introduction to readers of this Journal. We doubt that there is a more profound student of ordnance or a better qualified engineer in this very special field anywhere in the world. With so sweeping a statement we are not paying lip service to him. For 38 years—he was graduated from the United States Military Academy in 1896—he has served the country in a succession of important military assignments which culminated in 1930 in his appointment as head of the Manufacturing Service of the Department. To have mastered the engineering and the technique of one of the most intricate sciences, to have attained proficiency in the art of ordnance administration, and General Tschappat has done both of these, is an assurance that the defense equipment of our American military forces will continue on the same high plane to which his long line of predecessors in the office have brought it. As Chief of Ordnance of the Army General Tschappat, engineer, administrator, delightful gentleman and renowned scholar, assumes command at a time when all his experience, knowledge and personal qualifications will have many occasions to demonstrate their worth. On behalf of our Association we pledge to him our coöperation in every possible way.

Keen though our delight is in welcoming the new Chief, there are mingled feelings of regret that these changes in command mean the passing from the seats of the mighty of Generals Hof and Bricker. At times of parting it is well occasionally to disguise one's regrets with facetiousness; so we bid official adieu to these friends who will be leaving office soon, not as General Hof and General Bricker but as Sam and Ned. (If precedent is required for the unusual familiarity, we cite General Hof's self-styled "Swan song" at our New York Post meeting on April 20th.) What higher praise could there be than to confirm publicly what is in the minds of all who are familiar with ordnance affairs than to say that both have done good work and have done it well? Ordnance during their administration has progressed, the Department has functioned during an unsettled and trying period when less stout hearts might have faltered. With purse strings drawn tighter than usual, complaint more common than customary, change more popular than precedent, the Ordnance Department of the Army has kept an even keel refusing to be stampeded by changing popular whims and carrying on despite handicaps toward definite progress. For the Department as a whole credit for this record will be given ungrudgingly to him who was in command during the four dark years of depression. For the Field Service operations which have operated so well during the same difficult days observers and friends will compliment the retiring Chief of Field Service for his success in keeping the distributor points well contacted and the gears well greased when nearly every other machine was creaking loudly under the load. For General Hof in his retirement from active service and for General Bricker in

whatever new assignment is to be his, there should be every satisfaction in knowing that they have done well and that they have always the respect, admiration and well wishes of every member—military and civilian—of the Ordnance family.

AS the premier in some governments impersonates the state, so in matters relating to military supplies of the nation in time of emergency the Assistant Secretary of War impersonates industrial preparedness. To him as provided in the National Defense Act of 1920 both industry and the Army look for guidance and control of current military procurement and of industrial planning for a major war effort. It has been proved on innumerable occasions that this office and its work are one of the great lessons of our World War experience. To emphasize that lesson and to aid in a proper understanding of it this Journal was founded in the very year when the amended Defense Act came into existence. It has sponsored this cause as its own. It is natural enough, then, that we address ourselves to the insinuations of recent months which have transpired in connection with the policies of the office.

VICTORY IN A TEST CASE

We have witnessed a most unusual spectacle. When faced with its first major test fourteen years after its inauguration the Office of the Assistant Secretary of War, the citadel of industrial preparedness, was made the target of unscrupulous "fixers." The occupant of the office and his assistants were made the objects of charge and countercharge in the public press and the very system of procurement itself was placed in a shadow in the public mind. And all this, to the best of our knowledge and belief, without reasonable grounds upon which to base such an attack. The wily ways of some big butter-and-egg men, it seems, know few rules of procedure and less of consideration for reputations when individuals and time-tried systems stand in the way. As in the case of the General Staff of the Army, which existed for fourteen years before the World War gave it an acid test, so with the Office of the Assistant Secretary of War, its real trial came with its first major current procurement program. Its first decade was a term of study and research. When the Army in 1933, by virtue of the Civilian Conservation Corps and the appropriations for motorization and aircraft augmentation under the Public Works Administration, was faced with a really war-size procurement schedule the Office of the Assistant Secretary of War met its test—also fourteen years after its establishment. Immediately a large program of purchases was embarked upon, the attack on individuals and policies began. There were dissatisfied producers, unsuccessful bidders, and a great hubbub about "phoney" specifications. The result was a grand jury investigation which returned no bill.

After weeks of investigation and pitiless publicity no charges were brought, the practices as regards specifications and competitive bidding were found to be in order. So the result was merely to cast a temporary shadow on some individuals and to damage in the minds of some of our people a system of military procurement which the World War taught to be a necessity. Be it remembered that the Office of the Assistant Secretary of War is not an operating agency but simply one of supervision and coördination. Meantime the motorization program has not been embarked upon, thus delaying its Public Works phase, and costs have increased. Now that the smoke has cleared the only material result in all probability will be less Army motorization for the same money.

To our way of thinking this first real test of procurement policies under the Defense Act has strengthened rather than damaged the system; it has shown the usefulness of supervised and coördinated procurement; it has helped rather than hindered the crystallization of military procurement practices. The officials who were brought into the fracas are to be commended for their straight-forward attitude. We commend Mr. Woodring, the Assistant Secretary of War, who during a trying period acquitted himself as all who know him were confident would be the case. He is an energetic, sincere and untiring official; he has taken hold of an important function and is administering it most creditably. In the eyes of followers of industrial preparedness the esteem in which he is held has only been increased by the ordeal to which he was put. The officers of the Army who are assigned to his office are men of splendid judgment, inviolable integrity and sincere purpose. They too emerged from this test case without reproach. Industrial preparedness has not suffered by this test; on the contrary the system and the individuals who are now managing it have been shown to be sound, efficient and—about which there was never any doubt—honest.

THE steps toward modernization of the equipment of the Army so auspiciously begun under the aegis of the Public Works Administration is carried on in the Army Appropriation Bill for 1935. At least the bill after its passage by the House and Senate had all the earmarks of bringing modernization closer to accomplished fact. If the bill retains the modernization provisions the opinion of the chairman of the Sub-Committee, Congressman Ross R. Collins, as expressed when the bill was originally presented to the House of Representatives, is correct. The chairman said at that time that the Army bill is the best that has been brought in for many a year. For this the able chairman of the Sub-Committee and the members of the Committee are to be congratulated. We cite for special mention the address of Congressman Bolton of Ohio, ranking Republican member of the War Department Sub-Committee, presented when the bill was introduced. Not in many a day on the floor of the House of Representatives has industrial preparedness as contemplated by the National Defense Act been expounded and emphasized as efficiently as it was at the hands of Mr. Bolton. This in itself is an auspicious sign that industrial mobilization has its champions in legislative quarters where it also has some of its most outspoken enemies. It is refreshing to have the theory of this sane kind of preparedness explained competently and understandingly by a member of the Sub-Committee and augurs well for a better understanding and a more sympathetic attitude by those who control the purse strings.

MODERNIZATION OF THE ARMY

Modernization, however, has its application to administrative as well as actual supply functions. It is in the latter field where more modernization might well be authorized. We have embarked upon a program which when completed will place in the hands of the Army some up-to-date equipment. Aircraft, trucks, semiautomatic rifles, field artillery carriages are among the major items. It might be well if the quantities of this modernized equipment were not confined to those in actual use. A program of modernization along the

lines of a three-year plan, let us say, aiming at ultimate complete modernization would have many advantages. There are being modernized, for instance, enough of our field artillery carriages to supply the current training needs of the Regular Army and the National Guard. A concerted plan of modernization would extend to additional carriages not in active use. We imagine that many of these vehicles in storage have deteriorated beyond the point of immediate use. Wooden wheels will not stand the effects of time indefinitely and it might be that this equipment if needed in a hurry would not be useful at all. Whether the wood has stood the ravages of time or not, certainly the old field carriage could not be used at the speeds and with the modern truck equipment of today. If they are well preserved they cannot be used with trucks. If the wood is rotten even a horse can't pull them.

We talk now in terms of guns traveling at the rate of thirty miles an hour, of being ready for action immediately upon arrival at destination. Since artillery is so important as a reserve it would seem that a gradual modernization of all guns now on hand would be the only way to give that reserve its full value. It will not do in time of emergency in an era of mechanized armies to expect vehicles built for horse-drawn operation to stand up under the speeds of modern transport. And the doctrine of the small fast army is growing. The Secretary of War, Mr. Dern, in an address delivered on Army Day, brought out this point in a striking way. In his address we find such expressions as these: "Infantry of the old school would just be machine-gun fodder in the next war. If we want to win battles with the minimum loss of life we must put our infantrymen into tanks and armored cars." . . . "I am not advocating a large Army but I do feel that our little nucleus of an Army should be 100 per cent efficient and that it should be modern in every respect. There is nothing militaristic in that suggestion. It simply means that if we are to maintain even a semblance of a national defense establishment we must have modern implements of warfare and we must know how to use them."

We do not share the opinion sometimes expressed that the Army is not receiving proper support in administrative and legislative quarters. In many instances the Army has no complaint, in others it has good ground to expect a more liberal attitude. Its civilian administrative heads, Secretary Dern and Assistant Secretary Woodring, are in full sympathy with every plan within reason that looks toward efficiency and they are to be congratulated for their efforts. Mr. Collins, who is, it seems to us, at times intentionally irritating for the mere sport of the thing when he can find someone to irritate, has become a real protagonist for military mechanization. Mr. Bolton who was on the scene as an officer of the Army during the World War when the present National Defense Act was in formulation, knows the Army's needs. Under these auspices we believe a modernized United States Army will emerge and that efficiency, economy and readiness for service when needed will soon be an accomplished fact. This desired status will depend on the treatment accorded the men and the matériel. The men—commissioned and enlisted—require only to be treated as human beings whose livlihood, comfort and recompense are not trimmed to the point of too-great personal hardship. The matériel will pay dividends in protection whenever and wherever such dividends are being declared. Everyone will hope that these dividends are always passed—the passing itself is a good modernization investment.

Code Authorities

In an address before the annual meeting of the New York Post of the Army Ordnance Association on April 20th General Hof, who will soon relinquish his command as Chief of Ordnance of the Army, touched upon a significant development of recent weeks in respect of the effect of National Recovery Administration activities on industrial preparedness. He called attention to the detail of many Army officers to serve upon code authorities. Elsewhere in this issue announcement is made of the officers of the Ordnance Department who are engaged in part-time capacity on this work. As General Hof very well said in his address, our industrial mobilization plans "should make as much use as possible of changes caused by N. R. A. which are advantageous in emergency procurement planning."

The participation of officers in the work of various code authorities is a signal undertaking for more reasons than one. Recently a writer in one of the weekly magazines urged that more Army officers be so detailed because their inherent integrity might act as a leaven of good judgment. The allegation about integrity can be admitted but as to good judgment industry generally does not need military supervision. None the less the utilization of qualified Army officers on this work for the industrial contact is well worthy of emphasis. As General Hof pointed out, N. R. A. is in effect conducting a mobilization of industry; the methods followed parallel the methods used in the World War. The steps taken by N. R. A. have resulted in bringing about the organization of many industrial associations—actually the molding of many industries into an association. N. R. A. is extending the authority of these associations and both business and the public have new ideas on the uses of such bodies and their services to their respective industries and to the public. They offer new sources of information regarding production of equipment, production capacities and other data necessary for basing allocations for war materials. Procurement planning for a war emergency is in vain if it does not include industrial organizations as they exist at any particular moment in order that shifts and reorganizations may be avoided. Hence the War Department, and particularly the Ordnance Department, are observing with a great deal of interest the organization and functioning of N. R. A. and they are participating in its work. Industrial preparedness means, in its last analysis, the knowledge of what an Army must procure in war, how much and at what rates the procurement is to be, from what manufacturers and, so far as practicable, at what price and under what form of contract. Planning in this sense must be based on conditions as they are *today* otherwise, like the alleged statement of a former Quartermaster General concerning the Spanish American War, we will be organized but war will come along and spoil it all.

It is an indication of real progress that officers of the Army are thus permitted to obtain first-hand contact with industry through service on code authorities. Conversely it is an education for officers who some day may be in command in emergency—an education which no amount of theory and no book knowledge could give nearly as well. Industrial planning for national defense is in step; as long as it remains so it is marching forward. The important thing, it seems to us, is that when war is thrust upon a nation plans must be based on conditions as they are—not as they were or will be and not by any means as we wish they could be. Educational contact of this sort has its value for all concerned everywhere.

Facts About "Munitions Makers"

An Editorial

NOT since the World War—therefore not in the history of the United States—has our national defense been under the insidious attack now being waged against it under the guise of an exposé of our "munitions makers." Scarcely a day but the public press somewhere secondhands some grotesque story about these "war mongers"; scarcely a Sunday but some alleged minister of the gospel somewhere harangues a thinning congregation with absurd stories based, as a rule, on unsubstantiated propaganda about the activities of these "Merchants of Death"; scarcely a month but some magazine tells the story of the nefarious ways of these "dealers in blood money" and points its Holmeslike finger of guilt at our American "munitions makers." The latest campaign of this sort is the one undertaken by *Fortune*—the magazine "for those whose stake in this industrial civilization is greatest." In its March, 1934, issue a wealth of unsupported and unsupportable insinuation concerning United States and European "munitions makers" is spread upon the record. It is not new for propagandists to build conclusions on the flimsiest kind of premises. For those who are interested in facts we intend to set them forth here, fully conscious that readers of this Journal are familiar with them. We do so, however, in the hope that they may be brought to the attention of the many others who have swallowed the "munitions makers" hoax lock, stock and barrel. (This editorial will be republished in pamphlet form; copies of it will be mailed without cost to anyone who is—or should be—interested in *facts* concerning American munitions.)

Before discussing cases there are one or two general observations which should be stated to clear the atmosphere. ARMY ORDNANCE here confines itself to conditions in the United States. It is the spokesman for no company or individual here or abroad. It claims to know the vital importance of American munitions to our national defense. It claims further that to sit idly by when easily procurable facts are at hand to disprove the innuendo of the "campaign of frightfulness" would be to scuttle the great munitions preparedness lesson of the World War. We will confine ourselves to pertinent facts concerning "munitions makers" in the United States.

IN doing so we propose to begin with a discussion of a rather academic fact, namely, the answer to the question "What are munitions?" It is obvious that a great many of our people, including legislators, churchmen and editors, do not know, or maybe do not want to know, the meaning of the term. Webster says munitions are "Whatever materials are used in war for defense or for annoying an enemy; ammunition; also stores and provisions; military stores of all kinds; hence, necessary equipment or provision in general." This definition might be called the broad form, nevertheless it is accurate. Munitions are everything an armed force uses—from guns to chewing gum, from locomotives to shoes and socks, from tanks to tooth brushes, from army blimps to navy beans. Every single thing an army requires in its munitionment is included in the term and every single manufacturer in the land, under this definition, is or may be a "munitions maker." Obviously the present epidemic of complaint has a narrower definition in mind, munitions being understood to be synonymous with military guns and military ammunition only. In other words, in the narrow form "munitions" means "ordnance." Accepting gauge of battle on this basis what are the facts about our private "munitions makers" in the United States? What are the facts about the duPont Company, Bethlehem Steel, Midvale Steel, Colt's and Remington, the companies named by *Fortune* in its article, "Arms and the Men" as "perhaps the real heart of the armament business" of the world? With regard to these and every other company in the United States we make the unqualified statement—and we make it shamefacedly that it is true—that we have in this country not one manufacturing concern engaged exclusively or in any thing other than a very minor extent in the production of ordnance. To our knowledge there are three concerns of extremely small capacity which are engaged in the design and development of ordnance but their efforts, commendable as they are, are small to say the least and they are not the companies which *Fortune* has named as "perhaps" the heart of the business. (During the short interval between the original writing of this account and its going to press one of the three companies referred to was taken over by a receiver—so now there are two!) It is due entirely to the fact that we have only our Government arsenals and no private ordnance industry to speak of in this country, that our whole system of munitionment is built upon industrial preparedness. Every manufacturer in the United States is a potential munitions maker although today no one in his senses would claim that we have a private munitions industry worthy of the name. We mention this simply to invite attention to the fact that a false picture of the situation is extremely damaging to a people and a government whose military power depends not on peace-time production of munitions but on war-time ability to produce. To panhandle misleading statements on this tremendously important subject is to undermine the very crux of our ability to defend ourselves in any future emergency.

We have alluded to the fact that the companies named are not subject to the charge that they are "perhaps" the heart of the armament business and we support it not as their spokesman. We are interested in preventing the waste, delay and cost in lives and money which our munitions program in the World War met. If by facts we can succeed in correcting the injustice and absurdity of charges now being made so generally in respect of these companies and all others in the United States, we feel that we have the right and the duty to do so even though we speak for no individual concern. So let's have the facts.

THE duPont Company is generally made the stalking horse whenever "munitions makers" or "the armament business" is being played up. Yet the company today is not making, and during the past ten years has not made, enough military powder to subject it to a truthful charge of "munitions making" in any derogatory sense of the term—if that term is derogatory—and it most certainly is not. These are the facts about duPont's "munitions making": We find in the annual report of the company for the year 1933 that of the ten units conducting the principal manufacturing activities of the company the smokeless powder department (sporting and military

powders) ranks last in the dollar volume of business and in capital invested. The following tabulation from the company's report for 1933 shows this quite conclusively:

Department or Wholly Owned Subsidiary Companies	Dollar Volume of Business 1933	1932	Capital Invested 1933	1932
Organic Chemicals Dept. (Dyestuffs, tetra-ethyl lead, ethyl alcohol, and other organic chemicals)	1	1	1	1
Fabrics & Finishes Dept. (Pyroxylin finishes, paint and varnish, pyroxylin and rubber-coated fabrics)	2	2	5	5
The Grasselli Chemical Company (Inorganic heavy chemicals, acids, zinc, etc.)	3	3	2	2
DuPont Rayon Company	4	5	3	3
DuPont Cellophane Company	5	4	7	7
Explosives Dept. (Commercial explosives and blasting accessories)	6	6	4	4
The R. & H. Chemicals Dept. (Electro-chemicals and chemical specialties)	7	7	8	8
DuPont Viscoloid Company (Pyroxylin and acetate plastics and articles fabricated therefrom)	8	8	9	9
Ammonia Department (Synthetic ammonia, ammonia products, methanol and higher alcohols)	9	9	6	6
Smokeless Powder Department (Sporting and military powders)	10	10	10	10

Further, a stockholders' bulletin dated June 15, 1933, issued by the company over the signature of its President, has this to say, "By far the largest item among the company's products in the munitions category is smokless powder for use as a propellant; however, *our aggregate sales of this product have amounted to only 1.08 per cent of the company's total sales for the ten years 1923-1932 inclusive.* (Italics ours.)

And we might add that of this 1.08 per cent which the sales of smokeless powder during the above period bore to the company's total sales, 62 per cent was powder manufactured for the United States Government. The remaining 38 per cent (of the 1.08 per cent) was by no means entirely for foreign governments but, on the contrary, includes powders of the military type sold to the different domestic loading companies for use in sporting or shot gun ammunition. *In other words, 67/100 of 1 per cent of the duPont Company's income derived from sales of all products during the ten-year period were sales of powder to the United States itself, and 41/100 of 1 per cent were powder sales to shotgun ammunition manufacturers in the United States and to foreign buyers.* It is difficult to imagine any fair-minded individual contending that this minor activity of a great company and particularly these infinitesimal sales to foreign governments might even "perhaps" hold place in the heart of an international armament business!

AND so for the Bethlehem Steel Company, a name generally mentioned in the innuendo about "munitions makers." Here is a company which has been producing annually during the past ten years all kinds of commercial steel products which are those of nearly every other steel plant. These products include: Structural shapes; plates; rails and fastenings; frog and switch material; bars, carbon and alloy; reinforcing bars; pipe and tubes; tool steel and small tools; blooms, billets and slabs; sheet bars, wire rods; wire and wire products; sheet and tin plate; bolts, nuts, rivets and spikes; forgings, press, hammer and drop; wheels and axles; castings; cars, freight, passenger and mine; pig iron; ferro manganese. The ordnance materials—and they are not finished munitions—include rough gun forgings, armor plate, empty projectiles, air flask forgings, miscellaneous ordnance parts. During the period from 1924 to 1928 Bethlehem produced a relatively small quantity of complete projectiles and from 1924 to 1927 some very small quantities of component parts of finished guns. In the years 1924, 1931 and 1932 small quantities of armor plate were made. *During the past ten years the production of ordnance material for the United States Government was 95.3 per cent of Bethlehem's total production of ordnance material, leaving 4.7 per cent of the total ordnance material production for export.* Will readers of *Fortune* be surprised to know that *for the past ten years the value of all billings for ordnance material was 36/100 of 1 per cent of the total gross sales of the Bethlehem company?* (If *Fortune* readers are interested to know the actual annual averages we gladly give the figures for each year from 1924 to 1933 inclusive. *In each case the figure given is a fraction of 1 per cent.:* 1924—40/100, 1925—10/100, 1926—13/100, 1927—22/100, 1928—49/100, 1929—35/100, 1930—8/100, 1931—43/100, 1932—167/100, 1933—86/100.)

NOW turn to the facts as to the Midvale Company, another "prime offender" in the "munitions ring" insinuations! Midvale has made no finished munitions in the past ten years or for three or four years prior thereto unless some light armor ready to be installed on ships would come within the meaning of the term. The company has made a very few armor-piercing projectiles which were finished only to the point of loading and fuzing. No finished guns or gun mounts have been made by the company since shortly after the World War but some gun forgings have been produced for the United States Army and Navy. *During the past ten years all munitions or parts of munitions which Midvale has produced have been for the United States Government.* Here again we have a large steel plant which is making commercial products, in number and kind from locomotive driving and car wheel tires to quality steel and alloy steel castings of all descriptions, the detailed itemization of which would fill this page. The total sales by Midvale of armor-piercing projectiles, armor and plating for ships and gun forgings for the past ten year period—all of which, as we have said, were for the United States Government—bear the following percentage relationship to the total business of the company: *Armor, 3.71 per cent; projectiles, 4.10 per cent; gun forgings, 4.93 per cent.* For the sake of the record we give the figures for each individual year. It should be borne in mind that total sales having diminished substantially since 1929 and particularly in the last two years, this condition has had an important effect in increasing the per cent of total sales after 1929 in the following statement:

Year	Per Cent of Total Sales Armor	Projectiles	Gun Forgings
1924	None	None	9.67
1925	None	None	1.24
1926	None	None	4.96
1927	None	0.19	6.91
1928	None	7.66	3.39
1929	None	6.05	5.31
1930	1.72	11.10	4.16
1931	23.59	6.79	7.89
1932	23.11	None	0.60
1933	6.13	None	0.91
Actual average for ten-year period	3.71	4.10	4.93

AS to the Colt's Patent Fire Arms Manufacturing Company, we have a situation somewhat different from those of the three companies already mentioned. Its business is closer to being an armament maker than any of the others, it helps to arm our peace officers and our sportsmen. For all that, Colt's makes, in addition to revolvers and automatic pistols for our police forces and our shooters, military machine guns, metal parts of various kinds, hotel and restaurant dish-

washing machines, electrical supplies, including industrial and utility switches, fuses, etc., and an extensive line of hot molded products made from "Colt rock" and similar material, such as bakelite and "Durez." All these commercial products have been developed since the war. It may surprise readers of the current magazines and some of the clergy but scarcely the editors of *Fortune,* that during the past ten years more than 90 per cent of the arms production of the company was for domestic consumption. Considering all the various lines the company is manufacturing, including military equipment, *less than 10 per cent of the whole, on an average over the past ten years, has been exported.*

THE Remington Arms Company has not sold a military firearm during the last ten years. Its commercial products include sporting shotguns, sporting rifles, air rifles, shotgun shells, metallic ammunition, electric light socket linings, electric light candle tubes, clay targets, traps for throwing clay targets and cutlery. Its military product is metallic ammunition. *During the past ten years Remington sales to the United States Government averaged 1 per cent of its total business and its sales to foreign governments one-half of 1 per cent of its total business.* We present the following tabulation showing the percentage relationship of ammunition sales to the United States and to foreign governments in relation to total sales of the company. In doing so we wish to invite attention to the fact that sales to the United States Government were 3½ per cent of the total sales for the year 1933. This is the largest percentage of the last ten years. A large portion of these sales were of caliber .22 or small arms ammunition for target practice use.

Year	Gross Sales to U. S. Govt. % of Total Sales	Gross Sales to Foreign Govts. % of Total Sales	Total Sales to Governments % of Total Sales
1924	.1	.7	.8
1925	.1	.2	.3
1926	.1	.4	.5
1927	.3	.5	.8
1928	2.5	.1	2.6
1929	.2	.2	.4
1930	1.3	.6	1.9
1931	1.3	.2	1.5
1932	1.1	1.7	2.8
1933	3.5	1.8	5.3
Average	1.0	.5	1.5

THUS we have the factual picture of what *Fortune* calls "perhaps" "the real heart of the armament business." If its case against European armament makers rests on no more solid ground then it is a shabby case indeed. We anticipate, however, that in some quarters these facts will be brushed aside as zealots usually do with facts. When the case falls in fact it is usually made by insinuation. Some will contend, despite the facts, that these are the people who want war, who try to foment it and attempt to prolong it. If that be the attitude we will refute that with fact also. Turn again to the stockholders' bulletin of the duPont Company already referred to and we see such an insinuation nailed handsomely. The President of the company in the above bulletin has stated in black and white what anyone familiar with cases has known to be fact. We take the liberty of quoting from the bulletin at length:

"In view of the current public discussion of national armaments, and the healthy growth of popular opinion against war, it seems opportune to acquaint the stockholders with the position and policy of E. I. duPont de Nemours & Company with reference to the manufacture and supply of munitions.

"Ever since the establishment of the business in 1802 your Company has maintained a reasonable state of preparedness primarily to meet the needs of the United States Government in time of peace as well as in time of war for those munitions, the manufacture of which might properly be included in the activities of the powder and explosives industry. Furthermore, the Company has been requested and encouraged by our Government to maintain facilities for the production of munitions, if and when needed, in addition to the facilities which the Government itself maintains, and the Company has from time to time been given orders for peace-time requirements.

"At the request of the United States War and Ordnance Department the Company has, with many other corporations, participated in the 'Industrial Preparedness Program' developed by our Government since the close of the World War. This program has involved preparation of extensive plans, specifications and detail drawings in preparation for such construction and production as might be required by the United States in the event of war. One of the lessons learned from the World War is that such preparedness is one of our strongest guarantees of peace.

"The Company's policy with respect to the supply of munitions to Governments of other countries has been to keep in touch with the proper representatives of certain of these countries and to stand ready to consider the legitimate needs and proffered orders of all of them for munitions of such character as the Company can economically produce. The experience derived from the execution of such orders is of real value in maintaining some measure of preparedness by your Company for the possible use and benefit of the United States Government in an emergency. Business of this nature is sought but orders for munitions are not accepted without the knowledge of the appropriate departments of the United States Government at Washington, and unless special effort has been made to ascertain whether our Government has objection thereto. If such objections are received, orders of this kind are not accepted.

"The management feels that the success and prosperity of E. I. duPont de Nemours & Company are enhanced by world peace. The policies of your Company are governed strictly in accord with this conviction. There is no departure from this principle in the acquisition of a majority interest in Remington Arms Company, Inc., which, as pointed out above, is essentially and normally a manufacturer of sporting arms and ammunition; and your Company's part in the future management of the Remington business will be carried out in the firm conviction that we have a preponderant business interest as well as a plain duty to humanity in exercising whatever influence we may possess for the continued maintenance of world peace."

This attitude represents the belief of every reasonable individual. These facts as to the United States "munitions makers" as we have given them and the attitude, as we have quoted it will, we trust, have some effect in substituting facts for fancy in much of the current attack.

THERE *is* cause for alarm when we consider our "munitions makers" in the United States. It is not because they are doing an educational business in munitions-making; on the contrary, it is because they are not. Their infinitesimal activities are the only semblance we have of education in industrial preparedness in the event of another major war. If anyone believes candidly that there are huge profits in the business

or that there is a great peace-time demand let him turn to the records of the World War and scan the thousands of company names which appeared in our munitions-making program of those days and see that there are not a dozen of them so engaged in any manner whatsoever now. There comes to mind, for instance, the Westinghouse Company which made during the war more Browning machine guns than any other company in the United States—we venture to say that Westinghouse made twice as many as either Colt or Remington. Yet with the war over Westinghouse, typical of thousands, promptly returned to the manufacture of commercial products. We seem to remember that Marlin-Rockwell in 1917-18 claimed the distinction of the "world's largest makers of machine guns"—the company is not in the business at all today! Colt's in 1912 had approximately 950 employees. Necessary expansion to assist the United States Government and its Allies during the war resulted in the employment of more than 10,000 persons. Following the war the number of employees was reduced to about 700; with the acquirement and development of new lines of products this employment increased until today it is about 1,700.

As to the exportation of small arms by manufacturers in this country, the business is very much less than it was in pre-war years. Severe restrictions have been placed around the selling and purchasing of arms, and the cost of manufacture in this country is so much greater than in European countries, such as Spain, Belgium and Germany, that the export markets for the American product have been greatly restricted.

All of which comes down to the final fact that the "campaign of frightfulness" as it is being waged against our mythical "munitions makers" in the United States is a colossal smoke-screen which our warring pacifists, uninformed as usual, take seriously. As this seriousness grows in quantity by that much does munitions preparedness of the United States suffer. This too is *fact—ghastly fact*—about our American "munitions makers."

NOW the country is to have an official investigation of our "munitions makers." The United States Senate on April 12th adopted the Nye-Vandenberg Resolution (No. 206) which, with an appropriation of $15,000, calls for a searching scrutiny. The resolution provides for a special committee of seven Senators to be appointed by the Vice-President. On April 19th the following Senators were appointed to serve on the committee: Mr. Pope of Idaho, Mr. Bone of Washington, Mr. Clark of Missouri, Mr. Sheppard of Texas, Mr. Barbour of New Jersey, Mr. Vandenberg of Michigan and Mr. Nye of North Dakota. Subsequently, on April 23rd, Senator Sheppard tendered his resignation from the committee and Mr. George of Georgia was appointed in his place.

The resolution provides that the committee is authorized and directed "to investigate the activities of individuals, firms, associations and of corporations and all other agencies in the United States engaged in the manufacture, sale, distribution, import or export of arms, munitions or other implements of war; the nature of the industrial and commercial organizations engaged in the manufacture or traffic in arms, munitions or other implements of war; the methods used in promoting or effecting the sale of arms, munitions or other implements of war; the quantities of arms, munitions or other implements of war imported into the United States and the countries of origin thereof, and the quantities exported from the United States and the countries of the destination thereof." The committee will investigate existing legislation and treaties and it will review the findings of the War Policies Commission. Senator Nye who will serve as chairman of the committee expressed the hope, prior to the announcement of the committee members, that the body would be made up of men "inclined to go the whole route to ascertain the facts." Everyone will share the Senator's feeling in this regard. Let the country have the facts and let an end once and for all be put to the grotesque and absurd propaganda about our "munitions makers" that has been foisted on our people so blatantly during the past few years. There is nothing whatever to hide so far as our "munitions makers" are concerned. If the committee will approach the subject with an open mind and without the obvious antagonism which has characterized the talk of some of its members, then this investigation can be a very helpful and very constructive undertaking. We feel confident that everyone coming within the scope of the committee's authority who may be called upon to assist it in determining all the facts will do so most willingly.

The difficulty does not lie in finding the facts; they are available to anyone interested. The trouble lies in the misinterpretation of the facts once they are obtained, in the construction, the twisting and the half truths which partisan critics are prone to draw from them. For example, in an appendix to the *Fortune* article intended to prove that armorers after all are the true internationalists and that to prolong war and disturb peace they operate on the axiom, "If your enemy is in danger of running short of a basic raw material that he needs in the business of destroying your troops, sell him some of your own surplus stocks." What factual corroboration is adduced to prove this statement? Simply the following attributed to Rear Admiral Montagu Consett of England who is alleged to have said, "In 1915 England exported twice as much nickel to Sweden as in the two previous years put together. Of the total imports of 504 tons *70 tons were reshipped to Germany.*" (Italics ours.) Accepting this as true, the fact itself is that despite stringent control 70 tons of this material were "bootlegged" to the enemy. But what child's mind could draw from such a fact the conclusion *Fortune* draws? In other words, 70 tons of nickel, which we guess would have enabled German war industries of 1915 to operate a fraction of an hour, is held up as factual proof that munitions makers of warring countries were in league and were sustaining the armies of the enemy as well as those of their own country. Seventy tons of nickel proves that! All this is very silly but able-bodied men and women in the United States are making great capital of just such absurdity.

Hence it is that this fact-finding body can perform a truly great national defense service. It can settle once and for all the truth of the situation and it can impress upon interested people in the United States the seriousness of our own munitions problem. That problem is serious; anyone who doubts that it is need let his memory go back just twenty years when, as today, we had no "munitions makers" to speak of. We paid a terrific price to educate and mobilize American industry then to try to produce American munitions. The record is jammed full of the historic facts of our industrial unpreparedness. Our anti-munitions zealots have forgotten; for them history has given way to histeria. An open-minded investigation may reveal—not that the United States is at the mercy of our peace-time "munitions makers" but that our national defense is being undermined by munitions humbug.

A Federal Firearms Identification Bureau

An Editorial

THE science of firearm identification, sometimes referred to as "forensic ballistics," is now well established. Methods developed in the United States are in use throughout the civilized world and each year sees new laboratories organized to apply these in the investigation of homicides by firearms. Our bench and bar are rapidly coming to appreciate their value, as evidenced by the steadily increasing number of State Supreme Courts which have set their stamp of approval upon firearm identification as a recognized scientific tool in the war upon crime.

ARMY ORDNANCE feels a certain proprietary interest in this work, having published, in its November-December issue for 1925, the first article to describe the application of the comparison microscope to the field of firearm identification. This step may be said to have established forensic ballistics as an accredited science, taking it from the limbo of an unreliable and indefinite procedure and placing it upon a firm and substantial foundation. Within a year after the appearance of this paper, several investigators had adopted the comparison microscope for bullet and shell studies, and at the present time it is the backbone of some two score police and private laboratories throughout the United States including those of the U. S. Bureau of Standards and Department of Justice.

Subsequently ARMY ORDNANCE published additional articles on this subject in its July-August and September-October, 1933, issues. These described the rapid strides which have been made in this field since its modest beginnings in 1925.

THE question now arises as to whether firearm identification is being given adequate opportunity to prove its possibilities. Despite the advances which it has already made, it would appear that there lie before it virgin fields as yet unexploited. It is, as those conversant with it know, quite comparable with the science of fingerprinting in the service which it is prepared to render. Yet while the latter is being widely applied by our Department of Justice, that of firearm identification lies neglected. Daily two thousand fingerprints of persons arrested all over the United States are received in Washington. These are compared with some five million fingerprint cards on file in the archives of the Bureau of Investigation of the Department of Justice, and the peace officers submitting them are notified, within 36 hours after their arrival as to whether the persons from whom they were taken possess criminal records and what these records are. As a result, scores of badly wanted felons are identified and incarcerated every 24 hours.

Why should it not be feasible to establish a similar service in the field of firearms? Given an adequate reference collection of arms, ammunition and powders supplemented by data bearing upon the rifling characteristics of the various small arms now current, and aided by a small appropriation to make possible the purchase of new models of weapons and cartridges as they appear, our Government could be of inestimable assistance to its peace officers the country over. Thus a sheriff in Walla Walla, Washington, submitting a bullet removed from the body of a murder victim, would receive, within 36 hours after this had reached Washington, a report which in all probability would read like this: "This bullet was made by the blank ammunition company, it is of .38 Smith & Wesson type and was fired by smokeless powder through a .38 caliber revolver, the rifling characteristics of which are those of the A.B.C. make. The barrel of this arm was apparently quite rusty at the time." Mr. Sheriff then looks among his suspects for one owning an A.B.C. revolver of .38 caliber. Finding such an arm, he seizes it and sends it to Washington. In another 36 hours he receives a second report telling him whether this gun did or did not fire the fatal bullet.

THERE are probably fifty thousand small arms annually confiscated and destroyed in the United States. Were these instead turned over to the Government to form the backbone of a reference collection, such a collection would, within a year or two, be the finest in the world. Duplicate arms could be loaned or given to state and city identification bureaus maintaining their own arms laboratories. Excess weapons might be destroyed or, if of good make and serviceable, sold at moderate cost to peace agencies, Army officers and accredited members of the National Rifle Association. Such sales alone would go far toward supplying the entire annual budget of a Federal Fire Arm Identification Bureau. No one would object save arms manufacturers who would prefer to see these weapons destroyed, thus creating a demand for new ones to replace them.

We confidently predict that, given such a bureau, the number of unsolved crimes by firearms in the United States would decrease 50 per cent once the fact that such a service was available became generally known. Furthermore, the time and cost of investigating those solved through its aid would be cut another 50 per cent for the finger would point toward the guilty person from the beginning.

Another function of such an organization might well be the dissemination to state identification bureaus maintaining their own arms laboratories of information bearing upon new types of arms and ammunition appearing upon local and foreign markets thus keeping their staffs up-to-date on these subjects. Our government is prepared to send us circulars upon how to raise mushrooms or exterminate potato bugs. Would it not be more to the point were it in a position to help the local identification officer by the issuance of bulletins such as we suggest in his war upon organized crime? Potato bugs are public enemies but the "stick-'em-up" bugs are too, they also could stand a bulletin now and then!

The United States Department of Justice has presented to the Congress a 12-point program of legislation aimed to tighten the net on the gangster in his interstate marauding. The escapades of one Dillinger furnish a convenient opportunity to marshal support for the legislation among legislators who, being normally "states rights" men, would prefer to see the local authorities assisted in every possible way rather than "Federal men" do the job. A Federal Firearms Identification Bureau would be a step in the right direction; it would give scientific help to the local peace officer who may be as sharp as Scotland Yard's best but who hasn't the benefit of the science, the history, the equipment and experience which such a bureau could offer for the asking.

Association Affairs

Francis R. Dravo

As announced in the March-April issue of Army Ordnance, Mr. Francis R. Dravo, a charter member of the Army Ordnance Association, died in Pittsburgh, a victim of a railroad accident, on February 26, 1934. Word of the sudden and untimely death of Mr. Dravo was received as the last issue went to press.

Francis R. Dravo

We desire now to pay more fitting tribute to the memory of Mr. Dravo who filled a cherished place in the affections and esteem of many members of the organization. Mr. Dravo was born in Pittsburgh August 19, 1866. He was graduated from Lehigh University in 1887 and afterwards served as a trustee of that institution. For many years he was head of the numerous Dravo companies in the Pittsburgh area. He was president and director of the Dravo Contracting Company, vice-president and director of the Keystone Sand and Supply Company and a director of the Dravo Doyle Company. He also served on the directorate of many other industrial organizations in and near Pittsburgh. He was president of the Edgeworth Club, vice-president of St. Barnabas' Free Home and senior warden of St. Stephen's Church of Sewickley.

Mr. Dravo had served as a member of the Advisory Board of the Pittsburgh Ordnance District since April, 1929. He was active in all affairs of the Army Ordnance Association since its organization nearly fifteen years ago. With his brother, Ralph Dravo, who is now president of the Pittsburgh Post and who was chief of the ordnance district during the World War and for many years thereafter, the brothers Dravo personified by their public spirit and participation in national defense affairs the spirit of ordnance preparedness in their important locality. The loss of this leader is a severe one to the Army and to the Association as it is also to the many movements with which he was intimately connected including the development of inland waterways, marine engineering and railways as well as the charitable and philanthropic causes.

Mr. Dravo had in a remarkable degree the talents of leadership which he developed in a kindly quiet way. He had the rare charm of winning friends and of keeping them by his candor, good judgment and kindness. Upon the occasion of the fifteenth annual meeting of the Association in Pittsburgh last December these qualities of his personality permeated the several functions connected with the meeting. With his brother Ralph he was the genial host of a company of distinguished guests at the Duquesne Club in the morning and at other functions throughout the day. It was the good fortune of the writer of these lines to have been with him on this occasion when his good fellowship and intense interest in ordnance affairs were so delightfully in evidence. His sudden passing from the ranks of our membership removes a leader who had done much for the ordnance movement and whose place officially, and for many of us personally, will remain unfilled.

Milwaukee Post Meeting

Maj. Gen. Samuel Hof, Chief of Ordnance, was the principal speaker at a joint meeting of the Milwaukee Post, Army Ordnance Association, and the local branch of the Society of American Military Engineers held at the Milwaukee Athletic Club on March 30th. The meeting was preceded by a dinner at which about 130 guests were present. In the absence of Col. William W. Coleman, the President of the Ordnance Post who is now abroad, Lieut. Col. E. H. Tripe, Corps of Engineers, presided. Maj. Roger Sherman Hoar, Ord. Res., a director of the Ordnance Post, presented the speaker of the evening.

After congratulating Colonel Coleman and other members of the Army Ordnance Association for their untiring efforts in the ordnance cause, General Hof in his address presented a complete description of the functions of the Ordnance Department outlining many of its duties and impressing his hearers with the magnitude of the undertaking. He emphasized that thousands of items are included in the ordnance production and procurement plan. "These plans," he said, "Are not made up for a certain condition, filed away in some pigeon hole only to be brought out when that particular condition occurs but the plans are actually continuous being constantly changed to meet the requirements of troop organizations and the introduction of new matériel." As the success of these plans depends entirely upon the close coöperation of industry in peace time and in war time he urged a continuation of this coöperation on the part of industry.

Following General Hof's address, a general discussion of it took place under the leadership of Major Hoar. This feature proved of considerable interest to all present particularly with regard to educational orders for munitions. It was brought out that educational orders as such have not yet been approved by Congress, the attitude at present being the placement of all orders upon open competitive bids. The General's suggestion was that the attainment of educational orders would first require education of legislators that they may see the necessity of an educated industry in time of peace for its undertaking in an emergency.

Present at the meeting were many of the leading industrialists of the Milwaukee area, a large representation of members of the Milwaukee Post and many Ordnance Reserve and Engineer Reserve Officers resident in and near Milwaukee.

Ordnance Officers on NRA Code Authorities

Executive Officers of six of the Ordnance Districts have been appointed Government representatives on various code authorities under the National Recovery Administration. A number of officers from the Planning Branch, Office of the Assistant Secretary of War, including Lieut. Col. C. T. Harris, Jr., Ord. Dept., and Capt. H. U. Wagner, Ord. Dept., are serving in similar capacities. All are part-time assignments.

This opportunity for becoming familiar with current industrial procedure and for coördinating the active working of industry with industrial mobilization plans is most fitting; so far as the Army is concerned we feel sure it is welcome. Ordnance District Executive Officers who have received these appointments are: Lieut. Col. H. K. Rutherfore, New York; Maj. W. L. Clay, Pittsburgh; Maj. F. H. Miles, Jr., Hartford; Maj. R. W. Pinger, Cleveland; Maj. M. K. Barroll, Jr., Chicago; and Capt. J. D. McIntyre, Birmingham. An indication of the significance of this policy is presented among the editorials in this issue on page 360.

Ordnance District Confines

Instructions were recently issued by the War Department changing several of the long established territorial confines of some of the Ordnance districts. These modifications, we understand, grew out of the adoption of the Four Army plan and are intended to prevent overlapping authority as between procurement districts and tactical areas in the event of war. For instance, the state of Montana which formerly was included within the area

of the Chicago Ordnance District and the states of Wyoming, Utah and Arizona, formerly in the St. Louis District, are now parts of the San Francisco District. The city of Bristol, Virginia-Tennessee, is included in the Cincinnati District. Two new "inactive" districts will be established as follows: The states of Virginia, North Carolina and South Carolina will be withdrawn from the Baltimore District and will form a new district to be known as the Richmond district. The states of Arkansas, Oklahoma, Texas and New Mexico will be withdrawn from the St. Louis District and a new district to be known as the Houston District will be established for these states. These two new district headquarters will not be established in time of peace but will be operated from the Baltimore and St. Louis Districts, respectively. All records, reports and plans for the two new districts will be kept separately so that in the event of emergency they may be promptly transferred to the proper headquarters. The state of Tennessee for the present will remain a part of the Cincinnati District although the records for that state will be kept in such a manner that they will be separated readily. Under the new procedure the Bridgeport District will have its war-time headquarters in the city of Hartford, Conn., and as the policy is to name the district according to the city in which the headquarters will be located in time of war the Bridgeport District has been changed to Hartford District.

While it is quite obvious that changing conditions, industrial development and local progress may call for modifications of the limits of certain procurement districts, it seems on its face that no great advantage will accrue from such changes as these in time of peace. No one would establish an ironclad rule that the territorial limits of districts established during the World War must stand for all time. However, some weight should be given to the traditions which have grown up around the war-time districts during the past sixteen years and, unless there is some outright advantage which is not clear on the face of the record, we would prefer to see the old territorial boundaries remain intact in peace time. The industrial expansion of some states during the last decade is assurance enough that in time of war certain of the larger districts embracing such states might be subdivided to provide for closer contact and more immediate control. For instance, it is quite apparent that in any future emergency the establishment of a district headquarters in the city of Richmond to embrace the states of Virginia, North Carolina and South Carolina would be logical and necessary. The same goes for a war-time headquarters at Houston having under its jurisdiction the states of Arkansas, Oklahoma, Texas and New Mexico. Indeed many of the present districts might require a localization and nearness of headquarters to such an extent that other districts not now affected would be divided to meet future conditions. And we are not at all certain that it is not a good idea to decentralize now as much as conditions warrant. However, if the change in any way detracts from the efficiency that has grown up along the lines of organization which have existed since the war we would prefer that the *status quo ante* be maintained for tradition's sake if for no other.

A Grand Young Man of the Rifle

THE article in this issue of ARMY ORDNANCE on "Percussion Rifles" is worthy of special comment both by reason of its historical significance and its authorship. Capt. J. G. W. Dillin, member of the Army Ordnance Association, author of the renowned book "The Kentucky Rifle," is an authority on the old Pennsylvania flint locks whose fame on this subject makes his name synonymous with authentic research. Captain Dillin comes by inheritance into much of the love that is his for guns of the past and present. He was born and raised in the vicinity of Valley Forge, had two great-grandfathers with George Washington during the Revolution. His zeal for hunting and gunning has not declined with time, last year marking the 48th consecutive deer hunt credited to his account. His own title of captain comes from his service on the staff of the old 6th Pennsylvania National Guard in which he served from 1902 to 1916 and later from 1922 to 1929. He served as an instructor under General Kemp at the Mount Gretna Rifle Range, has burnt lots of powder and holds many records with the rifle, revolver and pistol. His strong point in rifle fire is offhand. His knowledge of guns as is evidenced in the article in this issue is an outgrowth of a lifetime of interest and actual experience.

ARMY ORDNANCE announces with regret the death, on March 20, 1934, of Prof. Henry W. Underwood, Jr., of Massachusetts Institute of Technology. He was a Captain in the Ordnance Section of the Specialist Reserve and was well known to the various classes in the Ordnance School who have taken his courses in powder and explosives. Not only was he highly accomplished in the work of his specialty, but his skill as a teacher and pleasant personality made him particularly efficacious in imparting knowledge to those students under his instruction.

Since publication of the last issue of ARMY ORDNANCE notice has been received of the death of the following members of the Association: F. L. Gilman, Montclair, N. J., and Acheson Smith, Greenwich, Conn. To relatives and friends of these deceased members ARMY ORDNANCE, for its readers, extends condolences.

New Members

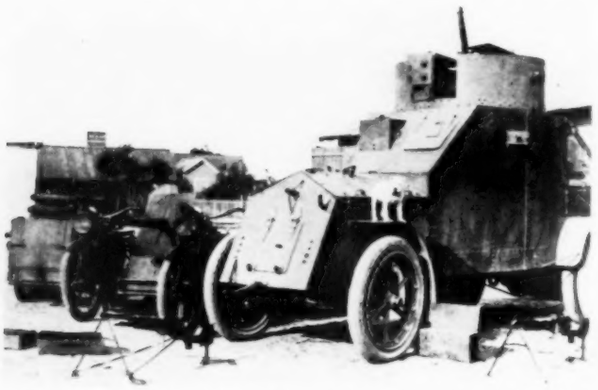
THE following have been admitted to membership in the Army Ordnance Association since the last issue of ARMY ORDNANCE: Bruce B. Baldwin, Tippicanoe City, Ohio; Harold Beavon, Cincinnati, Ohio; Sherroll L. Bettis, El Centro, Calif.; Ernest E. Bond, Wyoming, Ohio; H. C. Coventry, Rochester, Minn.; Guard C. Darrah, Stockton, Calif.; Henry W. Drake, Geneva, Neb.; O. H. Dunham, Decatur, Ill.; Joseph J. Farkas, Cincinnati, Ohio; Walter R. Foote, Hamilton, Ohio; Tom D. Fulford, Seattle, Wash.; Claud E. Fuller, Chattanooga, Tenn.; Fred J. Guenther, Cincinnati, Ohio; C. W. Hjelm, Worcester, Mass.; Robert E. Hurley, Cincinnati, Ohio; Melvin M. Johnson, Jr., Boston, Mass.; Ellis Knowles, New York, N. Y.; B. R. Lewis, Montevideo, Minn.; J. K. Lynch, New York, N. Y.; William E. McDermott, Dallas, Texas; George Van Horn Moseley, Atlanta, Ga.; Nelson E. Oliver, Thornton, Ill.; R. E. Patterson, Akron, Ohio; Nelson C. Peck, Meriden, Conn.; Emil F. Schnedarek, Cuyahoga Falls, Ohio; Lester Schreiberg, Cincinnati, Ohio; D. W. Sheldon, Pueblo, Colo.; C. H. Smart, Chicago, Ill.; Harry Snyder, Chicago, Ill.; J. M. Standish, San Francisco, Calif.; Alvin J. Striegel, Allentown, Pa.; Thomas W. Synnott, 2nd, Woodbury, N. J.; George H. Taber, Jr., Rye, N. Y.; L. R. Talbot, West Point, N. Y.; Uldric Thompson, Jr., Hastings-on-Hudson, N. Y.; Elmer C. Thuston, Birmingham, Ala.; Roy S. Tinney, Chatham, N. J.; Gilbert J. Ward, Ann Arbor, Mich.; A. C. White, Chicago, Ill.; E. J. Witzel, Cleveland, Ohio, and E. I. Woodbury, Maquoketa, Iowa.

THE INDEX AND TITLE PAGE
(for binding)
TO ARMY ORDNANCE, VOL. XIV,
which concludes with this issue is now in course of preparation.
Copies will be mailed to members and subscribers without charge upon application to
THE EDITORIAL OFFICES
Army Ordnance Association
Mills Building, Pennsylvania Ave. at 17th Street,
Washington, D. C.

Professional Notes

Evolution of the Mechanized Force

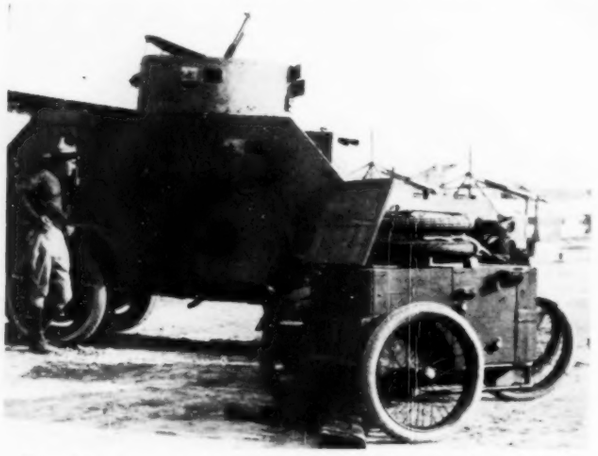
Ordinarily it is considered that the present Mechanized Force of the U. S. Army dates from about 1928, although there were in existence on the Mexican Border in 1916 two units, one at Fort Bliss, Texas, and one at Fort Brown, Texas, which in equipment and training, in view of the lapse of time since then, were comparable in efficiency and completeness to the present mechanized units. The unit at Fort Brown, Texas, was known as the 1st Provisional Motorcycle and Armored Car Company, and it was attached to the 4th U. S. Infantry.



"Spig," the White Dog (short for Spigoty) the First Mascot of a Mechanized Unit.

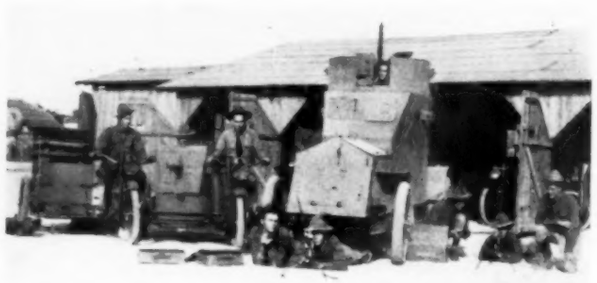
Spig hails from Vera Cruz, Mexico, where he accompanied the Machine Gun Company, 4th Infantry.

The fighting equipment consisted of one armored car on a White chassis and two Harley Davidson motorcycles with side cars, one equipped with a machine gun and an armored shield, the other serving as a maintenance unit for the company. In addition, there were 27 motorcycles with side-cars, carrying additional personnel armed with the rifle.



The Mechanized Unit of Almost Twenty Years Ago.

This unit in 1916 operated along the Mexican Border over a considerable extent of territory, and many a remote Mexican village of the Texas border was awakened in terror "in the small hours of the night" by the machine gun-like explosions of the motorcycles, as they forced their way through the mesquite. The unit patrolled by day and by night over roads, trails, and some times across country, as in one case, for five weary hours, the unit plowed through the gumbo of the Rio Grande River Road, to cover a distance of 25 miles from Brownsville to San Benito.



U. S. Army Mechanized Unit Prior to our Entry into the World War.

The Commanding Officer was First Lieutenant H. J. Lawes, 4th U. S. Infantry, now a major in the Quartermaster Corps. Instruction in machine guns was given by First Lieutenant G. P. Wilhelm, 4th U. S. Infantry, now a major in the Ordnance Department. Later, after Lieutenant Wilhelm became an instructor at the Ordnance Machine Gun School, of the Brownsville District Ordnance Depot, at Harlingen, Texas, the 1st Provisional Company, through his efforts, was given a special course of training at the school. Incidentally, this school, which was originated and very competently directed by Captain (now Major) Julian S. Hatcher, Ord. Dept., was the first school in the U. S. Army which gave a comprehensive course of training in the technical and mechanical problems of machine-gun firing. The attendance of the 1st Provisional Company at this school therefore marks the first organized training of a mechanized unit.

"Before the Battle."

Lieutenants Lawes and Wilhelm Consider the Seriousness of the Situation.

"After the Battle."

The Commander and Instructor Respectively of the First Mechanized U. S. Unit.

It will be noted in the illustrations on this page that the armored car is provided with a turret and with a machine gun which allows both ground and antiaircraft fire. Two other machine guns were carried in prepared brackets on the inside, for use as ground guns. The guns, of course, were the Benét-Mercie.

The armored motorcycle with the machine gun is of considerable interest since the equipment of the present day solo-motorcycle for similar purposes is without a shield and with a submachine gun. Such was the mechanized force in 1916.

A Symbol of Authority: General Dickson's Cane

HISTORY refers to many inseparable pairs. We find Pylades and Orestes, Castor and Pollus, Nisus and Euryalus, Damon and Pythias, Romulus and Remus, and others of a more modern age, ham and eggs, rock and rye, Haig and Haig, etc. A more intimate inseparable pair occupying a less widely known field should be included in these. This pair is General Tracy C. Dickson and his cane.

GENERAL DICKSON AND

HIS CANE.

General Dickson is recognized as a man of genius and achievement. His talents need no repetition here. His cane is almost as widely known, but its story remains hidden. It should be told for the benefit of posterity.

The early history of General Dickson's cane is shrouded. It is probable that the General himself is uncertain as to its origin. Upon its first appearance at the Watertown Arsenal it was variously reported to be of formidable proportions, of solid ebony, to be of great weight, etc. With the passage of time the stories became more confusing and Bunyanesque, particularly after the second or third telling. To some it possessed the properties of Aladdin's lamp, so quickly was the result accomplished after a wave of this cane directed the effort. It was an allotropic symbol. One day it was a cudgel, to rend the air or smite the floor with swish and echo, adding emphasis to the forceful expletives of its owner. Another time it was a sceptre, a fasces or talisman, representing all the authority of command, enunciated by vigorous thrusts and parries in the proximity of the subject. At times it was a giant scribe, used to draw large scale designs on the earthen floor or other substance capable of receiving its mark. Less frequently, it was simply a gentleman's stick, inconspicuous and well-behaved. Legendary tales, somewhat awe-inspiring when related to one who had not served this pair were, and continue to be, related wherever the receptive ear and instructive tongue are in congress.

In accordance with law, General Dickson was retired from active duty in 1932. The General, exercising that less well known sentimental side of his makeup, retired his cane at the same time. His last act at the Watertown Arsenal, as its commanding officer, was to lay this cane upon his desk and remark that he felt that it belonged to the arsenal. The arsenal felt the same way and gladly accepted this symbol of authority. It now reposes over the picture of its owner in the office of the commanding officer.

It was a bit disillusioning to see this pair separated, and to be permitted to examine the less conspicuous member at close range. A tradition has been shattered by this separation! Upon close inspection the cane was found to be of light wood, stained and varnished, well worn and the glossy surface broken and chipped here and there. The ferrule was worn and split. The ivory-tipped handle, inlaid with bits of silver, showed the marks of wear, caused by incessant gripping with a strong hand. As one holds it, it does not appear to have extraordinary powers. One has a feeling of reverence, but not of power. The separation of this historic pair has scattered the magic, it is like beholding Damon without Pythias, Romulus without Remus, Haig without Haig. Apart from its owner, it is no longer a symbol of power, it was just a cane—General Dickson's cane.

After replacing the cane over the picture and allowing one's mind to dwell on the past, the illusion returns. In the mind's eye the pair are never separated. The famous General and his cane will always remain together in the memories of those who have served with that famous pair.

Patent Digest

THE following chronology of recent ordnance patents was compiled by W. N. Roach, Chief, Patent Section, Office of the Chief of Ordnance:

No. 1,947,468 issued to William A. Gibson, Picatinny Arsenal, for a retarding device for parachutes. In this device the main parachute is retained in folded condition by a cord which is looped thereabout and passes through a friction device attached to the main parachute and thence to a pilot parachute the pull of which gradually unwinds the cord to free the main parachute.

No. 1,947,474 to Harry A. Knox, Office of the Chief of Ordnance, for a flexible band track. The main object of this invention is the provision of rigid members constituting driving lugs and wheel guides which strengthen, support and space endless flexible bands.

No. 1,947,502 to Col. Edward M. Shinkle, for a stop for rotating parts. This invention covers an improvement in the devices disclosed in prior patents to the same inventor and the object of the improvement is to reduce to a minimum the effort necessary in operating a mechanism of this character.

No. 1,947,507 to Samuel Wiley, Picatinny Arsenal, for a shock absorber for parachutes. Absorption of shock is accomplished in this instance by unwinding a cable attaching the parachute to the flare from a drum which has proper resistance to the unwinding movement.

No. 1,946,487 to August Dabrasky, Office of the Chief of Ordnance, for a fuze-setting machine. This patent covers an improvement over a former patent to the same inventor which is directed to the coupling means and consists in the convenient arrangement of a pair of opposed levers and their direct actuation by a single spring.

No. 1,946,485 to Capt. Richard C. Coupland, Raritan Arsenal, for a rate mechanism. This patent covers a rate mechanism consisting of a series of slides presented successively at a constant speed to a pinion capable of displacing the slides, and is directed more specifically to the mounting of the slides, to means for holding the slides in displaced position and transmitting this displacement, and to means for temporarily disengaging the driving gear from the slides when the driving gear is reversed.

No. 1,946,484 also to Captain Coupland, for a rate mechanism. This patent covers a rate mechanism including a cylinder driven at a constant speed and carrying movable racks, together with means for moving the racks from normal position and means for transmitting such movement.

No. 1,948,496 to Maj. G. M. Barnes, for a muzzle brake for guns. The patent covers a muzzle brake including a casing in which is a series of baffle rings provided with laterally projecting lugs which serve to space the rings from the casing and from each other.

No. 1,948,497 also to Major Barnes, for a gun. This is a specific cradle construction for guns.

No. 1,948,508 to Oscar M. Carleton, Watertown Arsenal, for a levelling device. The patent covers a head trunnioned in a rotatable ring, the head provided with diametrically opposite shoes the diametrical axis of which is at right angles to the axis of the trunnions. The shoes rest on a cam ring so that by proper rotation of head and ring the head may be leveled.

No. 1,945,511 has been issued to Capt. Richard C. Coupland, for a discharger. This invention relates to a recoil check for a grenade discharger.

No. 1,949,422 to James C. Karnes for a plotting device by which a target may be tracked with a range-finding instrument and the course of the target may be plotted automatically.

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—for Students of Military History;
—for Advocates of Peace with Preparedness;
—for Just Plain American Citizens who believe in National Defense for the United States without militarism, without excessive burdens, without exaggerated nationalism, without unfriendly designs upon anybody anywhere.

Readers can assist in disseminating sane views and current information on Industrial Preparedness and related subjects by recommending their friends and associates for membership in the Army Ordnance Association. Fill in the attached blank and forward to the Executive Offices of the Association, 806 Mills Building, Pennsylvania Avenue at 17th Street, N. W., Washington, D. C.

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Kindly extend an invitation to membership to them.

.....
Member A. O. A.

Letters to the Editor

A Plea for Munitions Quality

The Editor:

I have been very much interested in Mr. Millar's article "A Plea for Munitions Quality" in the September-October, 1933, issue of Army Ordnance, and in Captain Burdick's discussion in the November-December issue. In connection with the latter I also like the editorial "inset" which states that "Army Ordnance no longer conceives its sole purpose to be the mere setting forth in cold type of descriptions of matériel, etc." I am not satisfied that the inspection question has been adequately covered. In fact, I suspect Mr. Millar of talking about one thing and Captain Burdick about another.

As is well known, there are two types of specifications. One type states what a thing *is* and the other what it *does*. For example, a piece of armor plate may be described as having certain dimensions, chemical analysis, heat treatment, hardness, ductility, and so on. Or it may be described as a piece of metal which keeps out a given bullet arriving at a given velocity and angle of impact. The choice between these two types should be made by the engineer controlling the design and will depend upon a great many circumstances. The designer is not bound to use a specification unless it serves his purpose. If, however, he chooses the first type it is no business of the procurer and inspector to question the matter.

On the other hand if the designer prescribes a performance test the inspector should be mighty careful about substituting a check of related properties. For example, if a designer wishes a certain penetration test, the inspector should not be allowed to substitute Brinell measurements.

Coming back to the article in question I take it that Mr. Millar recommends the use of "is" specifications wherever possible. This, as he says, would permit the utilization of existing commercial facilities which is a point of no small import. Captain Burdick on the contrary prefers emphasizing the "does" type which would be very desirable if we had an unlimited corps of people who know military requirements. My own idea is that we use the first to the greatest possible extent, reserving our facilities for employing the second for matériel of the greatest importance. It goes without saying that we should avoid specifications which are *both* "is" and "does," for these frequently lead to inconsistency.

R. W. Pinger,
Cleveland, Ohio. *Major, Ord. Dept., U. S. A.*

Firearm and Liquor Laws

The Editor:

I have read with considerable interest the editorial "Laugh, Hoodlums, Laugh," appearing on page 302 of the March-April number of Army Ordnance. While I am in complete accordance with the view expressed, I should like to suggest that in the comparison made between liquor laws and proposed fire-arm laws, you have overlooked one important fact.

Liquor is difficult to transport and of relatively short life. To this extent, it may be classified as "expendable." On the other hand, a fire arm, once made, is here from now on and the time when replacement might be necessary is so far in the future as to be unpredictable.

This basic difference in the two commodities has an important bearing on the effectiveness of any measures aimed at their production, transportation or possession.

Shreveport, La. M. G. Stewart.

Book Reviews

WITH MY OWN EYES: A PERSONAL STORY OF BATTLE YEARS. By Frederick Palmer. Indianapolis: The Bobbs-Merrill Co. 1933. $3.50.

FREDERICK PALMER'S book is an exceedingly well written account of the travels and adventures of one of the world's best known war correspondents. With little or no superfluous anecdote, it carries the reader along; interest is seldom dulled and never lost. The sweep of history in the making, from Alaska and Panama in the West, to China and Manchuria in the East, is well covered by both observation and comment.

Palmer's almost unique experience as a correspondent from the last of the "black powder" wars (Turco-Greek of 1897), through the great conflict of 1914, covers the transition period, from "visible" to "invisible" fighting; and adds not only to the interest but to the value of his observations. And the author shows, by his evaluation of the events which he records and the lessons he draws therefrom that he has profited by a military experience which is far more varied and active than that which falls to the lot of most soldiers.

The greatest of the lessons to be drawn from Frederick Palmer's long experience "on the sidelines" of battle is that proper military and naval preparedness tends to prevent many needless conflicts and to shorten those which start, and therefore saves much needless bloodshed and loss. Closely akin to this, and even more clearly and repeatedly shown, is the unquestionable fact that *lack of proper ordnance, transport, and supplies, must always be paid for in human life!* To readers of ARMY ORDNANCE and to all other true friends of peace this alone would be sufficient to give real value to this book. But Palmer does not lose sight of the morale, or human, aspect of war. He records that he saw very considerable actual use of the bayonet in the Russo-Japanese war (especially at Mukden), and that Japanese officers unanimously agreed that this weapon gave a great stimulus to morale.

But, to this reviewer at least, the most interesting thing to be found in Palmer's book is the record of the phenomenal rise of the Japanese Empire. Missing only the war with China (which showed the Japanese people what they could do), he witnessed Japan's start as a world power in the Boxer Rebellion when the splendid fighting qualities of the Japanese troops opened the eyes of the officers of the Allied relief column. Through the Russian war, down to the present, when Japan strongly holds to Manchuria and the former German Caroline Islands in spite of world-wide protest, the Japanese have shown the same qualities of energy, courage, patriotism, and above all, unshakable determination to hold firmly to a carefully planned, and as yet unchecked, course of imperial expansion. After a careful reading of Frederick Palmer's "With My Own Eyes," it would seem to be the height of folly for any nation to underestimate this fighting race!

The volume itself is well printed; it has good photographic illustrations, an attractive cover in rippled leather-like finish, and a good cross index. This last adds materially to its handiness and value as a reference work, and reference work it is in a day when qualified writers are none too numerous. Too often statements on military questions are made by people who have no more qualification to speak than an otherwise efficient barber, and no statement is one bit better than the qualification of the man who makes it. Frederick Palmer has every right to write as he does. Eye-witness experience is his teacher.

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General Offices, Youngstown, O.

THE ECONOMICS OF MINING (NON-FERROUS METALS). By Theodore Jesse Hoover. Stanford University: Stanford University Press. 1933. $6.00.

THE distinguished author of this exhaustive work is well known in the field of which he writes in this book. He is equally well known wherever ordnance is discussed. A colonel in the Ordnance Reserve Corps, Professor Hoover is also a member of the Advisory Board of the San Francisco Ordnance District. He has been a guiding influence in industrial preparedness planning on the Pacific Coast and has assisted in many ways in furthering this important work. It is a particular pleasure for ARMY ORDNANCE to review a volume by so distinguished a member of the Army Ordnance Association.

We would not refer to this book as a technical treatise; it is rather an orderly presentation of certain theories and methods based upon good general practice. The basis for it is the broad personal experience of the author in many parts of the world and an intensive study of the literature of the subject. The text is divided for convenience of treatment into three main parts dealing respectively with the valuation of the mining project, the organization of a mining business and the management of a mine during its productive life. Mining, as the author notes, has been defined as "the art or practice of operating mines *profitably*." Until a mineral deposit may be worked with profit it is merely a prospect and, in the words of Professor Hoover "the concept of economic value is inextricably fused with the technical development of every mining undertaking."

He presents in an excellently documented volume of 547 pages the basic theories and practices of mine valuation, organization and management. It is particularly in the latter portion wherein the social aspects of management are treated that we find the key to success or failure of any mining undertaking. Indeed the concluding chapter, "The Young Engineer and his Career," might be written down as the advice of a Laertes to the student about to embark upon his profession. It is fitting that the volume include such valuable counsel when it is remembered that the volume itself is the outgrowth of a course of thirty lectures with problems and assignments given to students of mining and economics at Stanford University during the past ten years. As the author states, "The course was designed to assist young mining engineers in the latter years of their university training and in the early years of their professional life to supplement, coalesce and correlate the instruction they had previously received in the fields of economics, law, business and accounting, as well as in the technology of mining engineering." What finer thing than that the mining engineer have such a text as this to enable him to achieve "a noble eminence in the new world now in the making"! Colonel Hoover gives the mining engineer in this text a wealth of theory, practice and counsel which will be of inestimable value in the attainment of that eminence which already is his.

AN AMERICAN COLOSSUS. THE SINGULAR CAREER OF ALEXANDER HAMILTON. By Ralph E. Bailey. Boston: Lothrop, Lee and Shepard Co. 1933. $3.00.

TODAY is a particularly timely moment to reconsider Hamiltonian conceptions of government for the present centralized control, in the N.R.A. for example, far exceeds Hamilton's fondest dreams. Mr. Bailey's life of Alexander Hamilton therefore appears most opportunely. He admires Hamilton intensely, and his enthusiasm for the precocious West Indian youth who landed in this country in 1772 at the age of fifteen, is communicative. Although there are many available lives of Hamilton, Mr. Bailey's biography is a valuable addition for it is done artistically and with a nice sense of proportion in dealing with the various phases of Hamilton's career.

This is a notable book in that Hamilton's services as a soldier and a statesman, as well as his domestic and personal affairs

appear against a background of historical events in a fashion that makes the man and his epoch comprehensible and vivid. Washington's two chief advisers were Hamilton and Jefferson. The reader of this biography will probably conclude not only that Hamilton had a keen eye to the future, but also that the principles advocated by Hamilton are far more applicable today than those of his colleague.

THE ENGINE INDICATOR; ITS DESIGN, THEORY AND SPECIAL APPLICATIONS. By K. J. DeJuhasz. New York: Instruments Publishing Company. 1934. $3.75.

THE author of this work is Assistant Professor of Engineering Research at Pennsylvania State College and formerly was Chief Engineer, Lehmann and Michaels, manufacturers of indicators and engineering instruments, and research engineer for instrument and automotive companies. He has brought together in the short compass of 235 well illustrated and well documented handy-size pages a wealth of information for engineers whose daily activities depend upon the all-important questions of variable pressures, forces and motions, for those at work in power plants, engine factories, automotive and aeronautical research laboratories, pumping stations, truck and bus fleet shops who require a knowledge of pressures the indication of which should be more than a mere dial reading. Professor DeJuhasz takes us in back of the face of the indicator and explains how it works.

One chapter in particular is of interest to those whom the publishers refer to as "firearms people." We should say this chapter and other portions of the book will appeal to "ordnance people." Firearms, after all, is the accepted terminology for the small portable weapon. While pressures in this class of internal combustion machine are high, it is the larger caliber weapons where we find the exceptional forces that test the ingenuity of the physicist and ballistician.

Among the instruments in this catagory described by the author is the pencil type indicator developed by the Crosby Company which provides pressure diagrams where the pressure changes are not too rapid. For changes of the latter group coupled with high pressures the optical indicator designed by Prof. L. P. G. P. Thring and further developed by Dr. Hans Rumpff is described. Here the natural vibration period of the indicator must be exceptionally small. The essential feature of this instrument, based on information furnished by Dr. Rumpff, is the indicator spring which consists of two concentric tubes, the outer being in tension and the inner in compression when the piston is subjected to pressure. It is claimed that in virtue of the inherently high natural frequency of this type of spring the natural period of vibration of the piston can be as short as 0.00007, 0.00005, or even 0.00002 second.

The Balfour gun indicator of the British Ordnance Research Department of Woolwich is also described as well as the one developed by Kirner which, based on Newton's color rings produced in a narrow wedge-shaped slit by reason of the interference of light waves, is said to be an efficient optical interference indicator.

The author has succeeded in presenting the history, theory and construction of many forms of the pressure indicator from its inception to the present day. For so indispensable a piece of equipment in the many engineering investigations involving the measurement of forces and motions we believe this compendium of information on the subject will fill an important place in the library of the engineer.

ARMAMENTS YEAR-BOOK, 1933. GENEVA: LEAGUE OF NATIONS, 1933. (Available in the United States through the American Agency, The World Peace Foundation, 40 Mt. Vernon Street, Boston, Mass.)

THIS latest issue of the Armaments Year-Book, published in pursuance of the decision of the Council of the League of Nations

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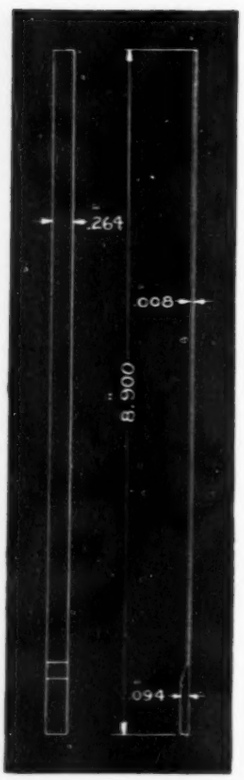

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of July, 1934, and in conformity with the principles laid down by the Council and the Assembly of the League, contains monographs on 64 countries, both members and non-members. It revises the preceding issue of the Year-Book and takes into account all important changes introduced in military legislation and in general, in the composition and organization of the armed forces of the different countries. In many instances where in former editions only summarized information was presented the data this year are more in detail. However, owing to differences in military systems and the transitional state of the law on armaments in certain countries it is not yet possible to follow a uniform plan in all cases.

The information on which the Year-Book is based is derived from two principal sources: (1) Communications from the several governments to the Secretariat of the League incident to the Conference for the Reduction and Limitation of Armaments; (2) Official publications of the different countries, such as collections of laws, official journals, official military bulletins, etc. In addition to these data there is at the end of the volume a bibliography for every country which appears in the Year-Book indicating all the documents consulted in the preparation of the present publication. There are also two annexes, the first of which relates to conventions, treaties and agreements concluded between different countries from 1817 to 1931 at present in force; the second contains a number of recapitulatory statistical tables and graphs showing world military expenditure, the essential characteristics of the army of each country, etc. There are 1,048 pages in the volume.

Despite the obvious efforts of the League's Secretariat to present the armaments picture for each country so that by comparison it may be aligned with any other individual country, the Year-Book is not able to present its material in this way and we doubt that until defense forces are standardized for the entire world any such comparative presentation is possible. Considering local conditions, which after all defense forces are created to protect, and considering the diversity of all the elements of these conditions for all countries, we doubt that it will be ever possible to compile such a yardstick. Nevertheless the Year-Book gathers together a factual summary of the defense systems and forces of the various governments and as such it is enlightening despite its failure to give any indication of a common denominator for disarmament.

THE COMPARATIVE LIFE, FIRE AND EXPLOSION HAZARDS OF COMMON REFRIGERANTS. By A. H. Nuckolls. Chicago: Underwriters' Laboratories. 1933.

THIS is a very timely report of investigations of the properties of refrigerants which may constitute health, fire or explosion hazards. Research and development are bringing into increasing prominence the use of refrigerating systems particularly for air-conditioning equipment in railways and public buildings. The introduction of new refrigerants which have not as yet had the test of actual service presents a growing need for more definite information concerning their properties as they relate to health, fire or explosion hazards.

The plan of investigation embraces the determination of any harmful physiological, or toxic action of the refrigerant in the form of vapor or gas upon the body, particularly when breathed. The fire and explosion hazards, as they are treated, describe the tests conducted such as measurements of reactions with the oxygen of the air, etc., and the relation of the results of these tests to the actual fire hazard.

A classification of the hazards of refrigerants followed by brief comments brings the report to a close. Considering the ever-growing use of mechanical refrigerating systems in the comparatively short past and the indications of their more general use in future makes this report a timely one of unusual value both to the producer, the user and the "consuming" public generally.

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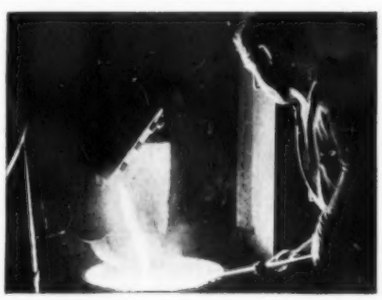

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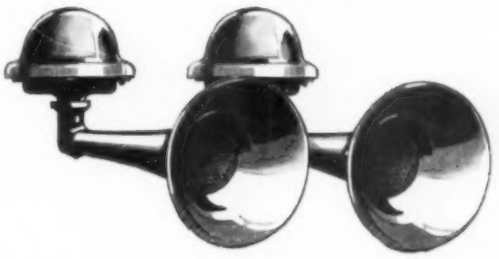

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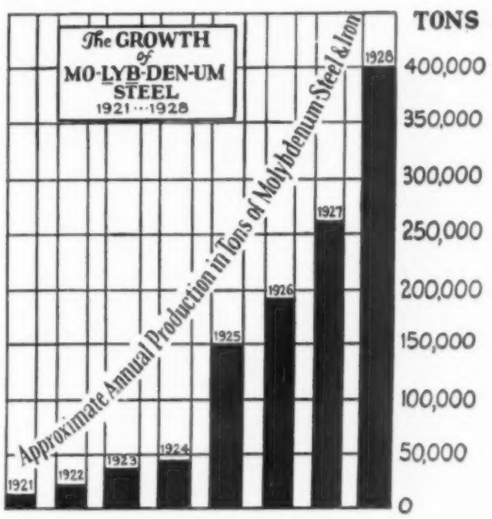

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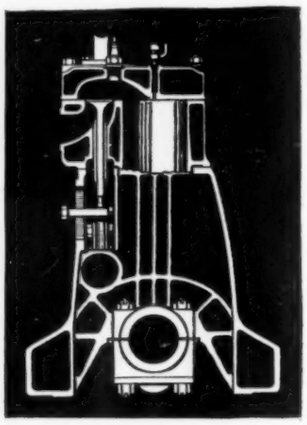

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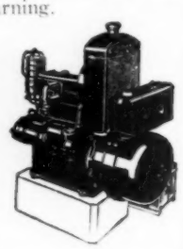

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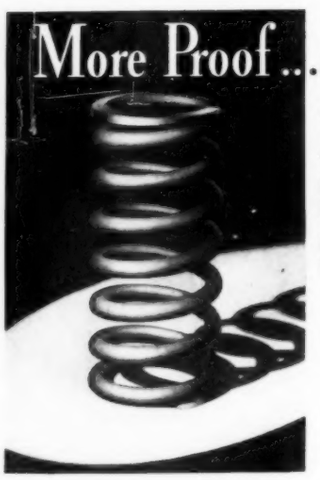

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One of the country's foremost clock manufacturers has found that it pays to standardize on sheet brass from a mill which makes sheets only—the Western Brass Mill. This manufacturer, like many others, has found Western brass consistently uniform in gauge, correct in temper and always of the same high quality. Western brass is an aid to a smooth, economical flow of production through your plant.

The Western Brass Mill makes highest quality flat, rolled Brass, Bronze, Phosphor Bronze, Nickel Silver; also special alloys for special purposes. Supplied in rolls, sheets, strips, plates and circles.

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HUNDREDS of industrial men have returned to their plants, after a visit to General Electric factories, convinced that the answer to almost any fabrication problem is already in the arc-welding-engineering files of the General Electric Company—convinced that all the arc-welding equipment they might need can be obtained on one order blank from one dependable manufacturer.

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140-31

GENERAL ELECTRIC

INSIGNIA
OF
THE ARMY ORDNANCE ASSOCIATION

THE medal of the Army Ordnance Association is suspended on the traditional Ordnance colors: crimson bordered with yellow and piped with black. The medal itself is struck from bronze of unusual historical significance. This material was used in a 6-inch howitzer of British manufacture which was captured by the German Army during the World War on the Russian front. Reconditioned by the Germans, the gun was put into service by them in the Argonne where it was captured by the 77th Division, American Expeditionary Forces. As shown in the accompanying illustration, the medal has on its obverse side the United States eagle and shield, the flaming bomb of ordnance and a superimposed scroll of the Association. The ribbon is of best quality grosgrain silk 1⅜ inches in width attached to a hidden bar pin with safety catch. The medal and ribbon are authorized for wear on the uniform in accordance with Army Regulations 600-40. All insignia of the Association are designed and manufactured by the well-known firm of medalists, Messrs. Bailey, Banks and Biddle of Philadelphia.

THE MEDAL

Price boxed $1.00

THE EMBLEM

The emblem of the Association for wear on the lapel of civilian dress, is furnished in bronze and 14 kt. gold. It is ⅜-inch in diameter and has on its face the ordnance bomb in black and crimson with the name of the Association on the outer edge.

Emblem in 14 kt. gold $3.50

Emblem in bronze . . . . . $ .50

THE MINIATURE MEDAL

The miniature medal is a replica of the larger medal ¾-inch in width suspended from a ribbon in the Association's colors. It is recommended for wear on civilian evening dress and is of standard size to accompany similar decorations.

Price 75c

THE LAPEL EMBLEM

THE BAR RIBBON

A bar ribbon 1½ inches in length by ¼-inch in width in crimson, yellow and black, authorized for wear on the uniform instead of the medal.

Price 25c

THE ASSOCIATION RIBBON

For wear on the lapel of civilian dress, the miniature ribbon of the Association ⅛-inch in width and suitably mounted, is available to members.

Price 15c

The standard ribbon of the Association identical with that on which the medal is mounted (1⅜ inches wide) is sold in lengths of not less than one-quarter of a yard.

Ribbon (1⅜ inches wide) per yard . . . $2.00

Ribbon (¾-inch wide) per yard . . . $1.20

INSIGNIA OF THE ASSOCIATION ARE FOR SALE TO MEMBERS ONLY

Address Orders and Inquiries to

THE ARMY ORDNANCE ASSOCIATION

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PENNSYLVANIA AVENUE AT 17TH STREET

WASHINGTON, D. C.

Remittances should be made payable to TREASURER, ARMY ORDNANCE ASSOCIATION

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Beryllium Copper is a truly remarkable metal possessing very high physical properties and differing from other copper alloys in that these physical properties *can be substantially increased by heat treatment.*

Further information sent upon request.

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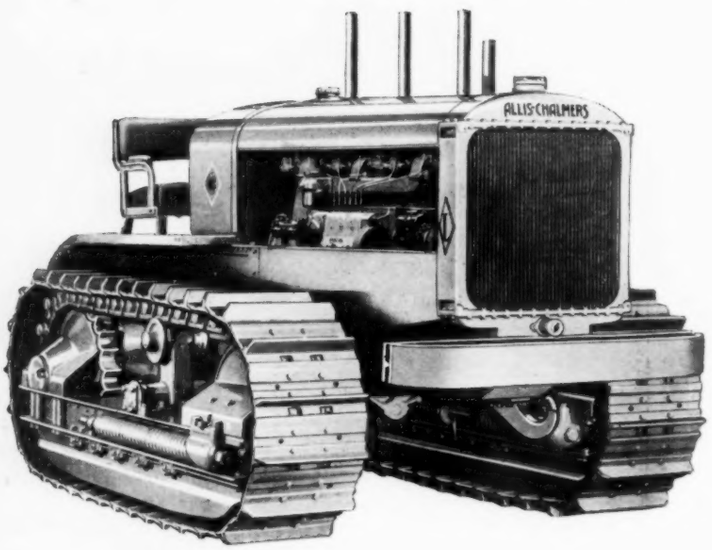
Announcing....

the new Models "L-O" and "K-O" OIL TRACTORS



In announcing the Allis-Chalmers Oil* Tractors, Models "K-O" 48 H.P. and "L-O" 76 H.P., we introduced an entirely new, successful principle in tractor engines. We use a Diesel fuel pump to inject the measured charge of fuel oil into the combustion chamber and ignite it with a spark. We do not depend upon compression for ignition, but use the time tried magneto. This engine operates with less maintenance cost, because the internal pressures are less than one-third those used in the compression type.

With confidence we offer this engine, knowing that it will do more work at less cost than any other tractor engine.

* Hesselman Patents.

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ASK any skeet shooter about those incoming targets, especially when they've got the wind behind them. He'll say they're faster than snipe in a gale.

They'll put goose eggs on your score unless you shoot fast and use the fastest, hardest-hitting powder you can get; a powder that shoots the same today, tomorrow and all the time, on the coldest or the hottest day, the dampest or the driest. That's Hercules Red Dot Powder; and leading skeet and trap shooters prove that they know this by the marked preference they show for Red Dot.

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Is this the toughest shot in

SKEET?

SKEET enthusiasts have as yet reached no agreement on this point. What *is* the hardest, most bewildering shot in Skeet? Some say it's mighty tough when the whimsical "birds" show only their thin sides. Others contend that the No. 8 Post (just midway between the two houses) is tops. There, the birds whip over your head before you know it . . and you must shoot fast . .

Whichever it is, there's one thing they all have settled quite definitely. And that is—that Skeet is just about the most fascinating, most exciting sport that's come along in many a day.

So many people think this, in fact, that Skeet fields are springing up like mushrooms all over the country. And why not? You can build your own field, you know, for as little as $100.

Du Pont will be glad to send you a copy of "Skeet Shooting Hints" which tells you more about this fascinating sport. Write for it. E. I. du Pont de Nemours & Co., Inc., Sporting Powder Division, "Dept. AO-5," Wilmington, Del.

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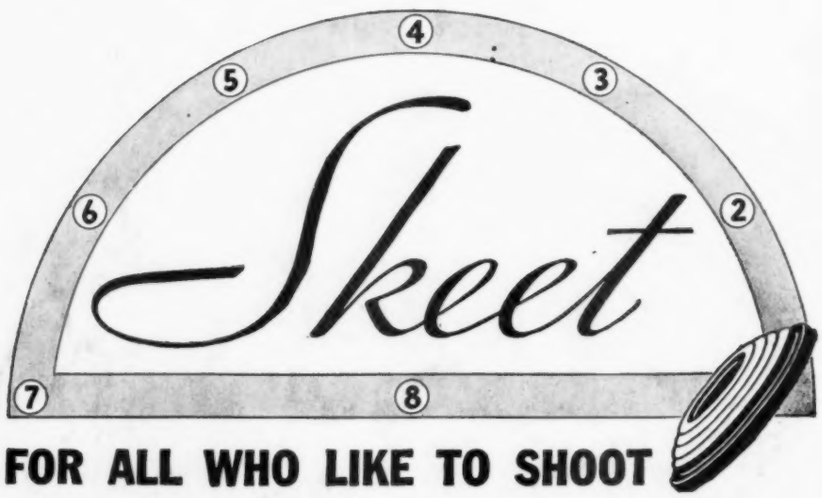

FOR ALL WHO LIKE TO SHOOT